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U.S. Army Corps
of Engineers
Coastal and Hydraulics Laboratory

Proceedings of the 79th Meeting of the Coastal Engineering Research Board

6-10 June 2005 (Anchorage, AK)

Hosted by: U.S. Army Engineer Division, Pacific Ocean, and the U.S. Army Engineer District, Alaska

Prepared for Headquarters, U.S. Army Corps of Engineers

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Contents

Preface

The Proceedings of the 79th Meeting of the Coastal Engineering Research Board (CERB) was prepared for the Office, Chief of Engineers, by the U.S. Army Engineer Research and Development Center's (ERDC's) Coastal and Hydraulics Laboratory (CHL). These proceedings provide a record of the papers presented, the questions and comments in response to them, and the interaction among program participants and CERB.

The 79th meeting was hosted by the U.S. Army Engineer Division, Pacific Ocean, under the direction of BG Robert L. Davis, and the U.S. Army Engineer District, Alaska, under the direction of COL Timothy J. Gallagher. Acknowledgments are extended to the following from the Alaska District: Messrs. Bruce R. Sexauer and Kenneth J. Eisses for overall coordination and field trip assistance; Mses. Chelan J. Schreifels and Mary T. Wilson for logistical and administrative support; and Mr. Merlin D. Peterson for computer support. Thanks are also extended to all speakers, to Ms. Sharon L. Hanks of CHL for overall coordination and assistance in the setup of the meeting and the assembly of the information for this publication, Mr. Clay W. LaHatte of CHL for placing Proceedings on the Internet, and Mr. Bill Mullen of ERDC's Information Technology Laboratory for editing these Proceedings. Thanks are extended also to Ms. Susan C. Soderberg, Pro/Tech Reporting Services, for taking verbatim dictation of the meeting.

These Proceedings were reviewed and edited for technical accuracy by Mr. Thomas W. Richardson, Director of CHL, and COL James R. Rowan, Executive Secretary of the Board.

The document is approved for publication in accordance with Public Law 166, 79th Congress, approved 31 July 1945, as supplemented by Public Law 172, 88th Congress, approved 7 November 1963.

DON T. RILEY
Major General, U.S. Army
President, Coastal Engineering Research Board

Agenda

Monday, 6 June 2005

0700 – 1900 CERB Board Site Visit (Nome and Shishmaref)

Tuesday, 7 June 2005 (Meeting Attire: Civilian – Business Casual; Military – Class B)

0800 – 1300 Registration Outside Conference Room (Summit Hall of Egan Center)

0800 – 1130 CERB Executive Board Meeting

1130 – 1230 Lunch (on own)

General Session Begins at 1230 (Summit Hall – Egan Center)

1230 - 1245 Opening Remarks
MG Don T. Riley, Director of Civil Works

1245 – 1300 Welcome to Pacific Ocean Division (POD) and Alaska District (POA)
BG Robert L. Davis, Commander, COL Timothy J. Gallagher, POA

1300 – 1330 Tsunami Warning Center Operations
Mr. Bruce W. Turner, West Coast & Alaska Tsunami Warning Center

1330 – 1400 Pacific Risk Management ‘Ohana: A Shared Vision for Integrated Risk Management in the Pacific
Ms. Eileen L. Shea, East-West Center, Honolulu, HI

1400 – 1430 Break

1430 – 1500 Alaska Modeling and Data Issues
Mr. Bruce A. Ebersole, Coastal and Hydraulics Laboratory (CHL)

1500 – 1530 Alaska Ocean Observing System (AOOS)
Ms. Molly McCammon, AOOS

1530 – 1600 Pacific Islands Integrated Ocean Observing System: Building a Foundation
Ms. Shea

1600 – 1615 First Day Closing Remarks
MG Riley

1830 - 2030 Social/Dinner (Attire: Civilian Casual)

Wednesday, 8 June 2005 (Meeting Attire: Civilian – Business Casual; Military – Class B)

0800 – 0815	Opening Remarks MG Don T. Riley, Director of Civil Works
0815 – 0900	Honolulu District Coastal Research and Development Needs Mr. Thomas D. Smith, Honolulu District
0900 - 0945	Climate Change Impacts on the Alaska Coastline Dr. Orson P. Smith, University of Alaska Anchorage
0945 – 1015	Break
1015 – 1045	Developing Wind/Wave Hindcast Climatologies for Alaska Dr. David E. Atkinson, University of Alaska Fairbanks
1045 – 1145	Subsistence and Cultural Issues Why is Subsistence so Important for Alaskan Communities? Mr. Taylor Brelsford, Bureau of Land Management Collaborative Approaches to Complex Problems Dr. Henry P. Huntington, Huntington Consulting
1145 – 1330	Lunch (on own)
1330 – 1400	The Denali Commission Mr. Al Ewing, Denali Commission
1400 – 1430	North Slope Science Initiative Mr. Kenton P. Taylor, Bureau of Land Management
1430 – 1500	Report of Newtok Mr. Stanley Tom, Community of Newtok, AK
1500 – 1530	Break
1530 – 1650	Discussion Shishmaref, Alaska (Panel) Ms. Patricia S. Opheen, POA, Moderator Coastal Engineering: Tribal Partnership, Shishmaref, Alaska Mr. Alan C. Jeffries, POA Policy and Planning Issues Mr. Bruce R. Sexauer, POA Shishmaref Erosion and Relocation Coalition Ms. Luci Eningowuk, Shishmaref Erosion and Relocation Coalition
1650 – 1700	Closing Remarks for Day 2 MG Riley

Thursday, 9 June 2005 (Meeting Attire: Civilian – Business Casual; Military – Class B)

0800 – 0815	Opening Remarks MG Don T. Riley, Director of Civil Works
0815 – 0900	Port of Anchorage Governor William J. Sheffield, Port of Anchorage
0900 - 0945	Cook Inlet Sedimentation and Modeling Mr. John G. Oliver, John Oliver Consulting
0945 - 1015	Break
1015 – 1045	Alaska District Dredging Program Mr. E. Allen Churchill, POA
1045 – 1115	Subsistence Harbors in Alaska Mr. Kenneth J. Eisses, POA
1115 - 1145	Public Comment
1145 – 1200	Board Recommendations/Remarks Board
1200 – 1215	Closing Comments MG Riley
1215	Adjourn General Session
1230 – 1630	Board Lunch and Executive Meeting
1630 – 1800	Board Tour Port of Anchorage
1800 – 2000	Board Dinner

Friday, 10 June 2005 (Optional) (Attire: Casual)

0800 – 1100	Motorcoach Field Trip to Seward via Turnagain Arm
1100 – 1130	Tour Seward Harbor Project
1130 – 1400	Self-Tour of Seward and Lunch (on own)
1400 – 1700	Return to Anchorage
1700	Adjourn for Dinner (on own)

Attendees

Board Members
MG Don T. Riley
BG Robert L. Davis
BG Merdith W. B. Temple
BG Michael J. Walsh
Dr. Billy L. Edge
Dr. Joan Oltman-Shay
Dr. R. Bruce Taylor

Headquarters, US Army Corps of Engineers
MAJ Hugh Darville, CECW-ZX
Dr. Michael J. O'Connor, CERD-ZA

Institute for Water Resources
Mr. Charles B. Chesnutt, CEIWR-PD

Detroit District
Dr. James P. Selegean, CELRE-HH-E

North Atlantic Division
Mr. Andrew Petallides, CENAD-BTD

New York District
Ms. Jennifer L. Irish, CENAN-EN-HC

Northwestern Division
Mr. Albert R. Swoboda, CENWD-RBT

Alaska District
COL Timothy J. Gallagher, CEPOA-DE
Mr. Stephen C. Boardman, CEPOA-PM-CW
Mr. Carl E. Borash, CEPOA-EN-CW-PF
Mr. Forest Brooks, CEPOA-EN-CW-PF
Mr. E. Allen Churchill, CEPOA-CO-O
Mr. Kenneth J. Eisses, CEPOA-EN-CW-HH
Ms. Deirdre M. Ginter, CEPOA-EN-CW-HH
Mr. Dennis L. Hardy, CEPOA-EN-CW
Mr. Phil Hunt, CEPOA-PM
Mr. Alan C. Jeffries, CEPOA-EN-CW-HH
Ms. Patricia S. Opheen, CEPOA-EN
Mr. Pete G. Perez, CEPOA-CO-SA
Mr. Merlin D. Peterson, CEPOA-EN-CW-HH
Ms. Patricia L. Richardson, CEPOA-PA
Ms. Chelan J. Schreifels, CEPOA-EN-CW-PF
Mr. J. Larry Scudder, CEPOA-EN-CW-PF
Mr. Bruce R. Sexauer, CEPOA-EN-CW-PF
Ms. Mary T. Wilson, CEPOA-EN-CW-HH

Honolulu Distict
Mr. Thomas D. Smith, CEPOH-EC-T

South Atlantic Division
Mr. Kaiser E. Edmond, CESAD-MT-EW

Jacksonville District
Ms. Jessica C. McCaffrey, CESAJ-EN-A

Mobile District
Ms. Linda S. Lillycrop, CESAM-EN-HH
Dr. Susan Ivester Rees, CESAM-PD-EC

Los Angeles District
Ms. Susan M. Ming, CESPL-PD-WS

San Francisco District
LTC Philip T. Feir, CESPN-DE

Engineer Research and Development Center
COL James R. Rowan, CEERD-ZB
Ms. Joan Pope, CEERD-ZB-A

Coastal & Hydraulics Laboratory
Mr. Thomas W. Richardson, CEERD-HV-ZA
Mr. Stanley J. Boc, CEERD-HF-FF
Dr. Jack E. Davis, CEERD-HC-T
Mr. Bruce A. Ebersole, CEERD-HC-C
Ms. Sharon L. Hanks, CEERD-HV-Y
Dr. Steven A. Hughes, CEERD-HN-HH

Cold Regions Research and Engineering Laboratory
Mr. Peter D. Smallidge, CEERD-RV-I
Mr. James L. Wuebben, CEERD-RV-ZA
Mr. Jon Zufelt, CEERD-RT

Guest Participants
Dr. David E. Atkinson, University of Alaska, Fairbanks, AK
Mr. Taylor Brelsford, Bureau of Land Management, Anchorage, AK
Ms. Luci Eningowuk, Shishmaref Native Corporation, Shishmaref, AK
Mr. Al Ewing, Denali Commission, Anchorage, AK

Dr. Henry P. Huntington, Huntington Consulting, Anchorage, AK
Ms. Molly McCammon, Alaska Ocean Observing System, Anchorage, AK
Mr. John G. Oliver, John Oliver Consulting, Sherwood, OR
Ms. Eileen L. Shea, East-West Center, Honolulu, HI
Governor William J. Sheffield, Port of Anchorage, AK
Dr. Orson P. Smith, University of Alaska, Anchorage, AK
Mr. Kenton P. Taylor, Bureau of Land Management, Anchorage, AK
Mr. Stanley Tom, Newtok Traditional Council, Newtok, AK
Mr. Bruce W. Turner, West Coast & Alaska Tsunami Warning Center, Palmer, AK

Guests

Mr. Ben M. Angel, URS Corporation, Anchorage, AK
Mr. David Beiswenger, Colorado State University, Ft. Collins, CO
Ms. Elizabeth Beiswenger, Cambridge University: Scott Polar Research Institute, Cambridge, England
Mr. Russell Boudreau, Moffatt & Nichol, Long Beach, CA
Ms. Ruth Carter, Alaska Department of Transportation and Public Facilities, Anchorage, AK
Mr. John Daley, Tryck Nyman Hayes, Anchorage, AK
Mr. Claude Denver, Alaska Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management, Ft. Richardson, AK
Mr. Craig Freas, Tryck Nyman Hayes, Anchorage, AK
Ms. Mikki Gaddis-Toimil, Moffatt & Nichol, Seattle, WA
Mr. Frank Gerjevic, Anchorage Daily News, Anchorage, AK
Mr. Adam Green, Colorado State University, Ft. Collins, CO
Mr. Bauke H. Houtman, Ocean.US, Arlington, VA
Mr. Douglas F. Jones, Coastline Engineering, Anchorage, AK
Mr. Gary L. Martin, Alaska Business Monthly, Anchorage, AK
Ms. Christi L. Miller, Department of Commerce, Anchorage, AK
Mr. Shaun McFarlane, Tryck Nyman Hayes, Anchorage, AK
Ms. Kim Nielsen, Tryck Nyman Hayes, Anchorage, AK
Mr. Brad Petersen, Tryck Nyman Hayes, Anchorage, AK
Ms. Yereth Rosen, Reuters, Anchorage, AK
BG William J. Sharrow (U.S.A. Retired), Office of Congressman Don Young, Anchorage, AK
Mr. Harvey N. Smith, Alaska Department of Transportation and Public Facilities, Anchorage, AK
Mr. Victor Winters, Department of Transportation, State of Alaska, Juneau, AK
Mr. George Wuerch, Knik Arm Bridge and Toll Authority, Anchorage, AK

Court Reporter

Ms. Susan C. Soderberg

Introduction

The 79th meeting of the Coastal Engineering Research Board (CERB) was held in Anchorage, AK, 6-10 June 2005. It was hosted by the U.S. Army Engineer Division, Pacific Ocean (POA), under the direction of BG Robert L. Davis, Commander, and the U.S. Army Engineer District, Alaska, under the direction of COL Timothy J. Gallagher, Commander.

The Beach Erosion Board (BEB), forerunner of CERB, was formed by the U.S. Army Corps of Engineers in 1930 to study beach erosion problems. In 1963, Public Law 88-172 dissolved BEB by establishing CERB as an advisory board to the Corps and designating a new organization, the Coastal Engineering Research Center, now ERDC's Coastal and Hydraulics Laboratory (CHL), as the research arm of the Corps. CERB functions to review programs relating to coastal engineering research and development and to recommend areas for particular emphasis or suggest new topics for study. The Board meets twice a year for the following purposes:

a. Disseminate information of general interest to Corps coastal Districts or Divisions.

b. Obtain reports on coastal engineering projects in the host (local) District or Division; receive requests for research needs.

c. Provide an opportunity for state and private institutions and organizations to report on local coastal research needs, coastal studies, and new coastal engineering techniques.

d. Provide a general forum for public inquiry.

e. Provide recommendations for coastal engineering research and development.

Presentations during the 79th CERB meeting dealt with pertinent topics relative to the Pacific Ocean region and, in particular, Alaska, including tsunamis; Alaska and Pacific Islands Ocean Observing System; data, climate change, and cultural issues, including the communities of Newtok and Shishmaref, AK; and harbors and ports. Documented in these proceedings are summaries and/or abstracts of presentations made at the meeting, discussions following these presentations, and recommendations by the Board. Documentation and verbatim transcripts of the 79th meeting are on file at ERDC's CHL.

Members

MG Don T. Riley, President
Director of Civil Works
US Army Corps of Engineers
441 G Street, NW
Washington, DC 20314-1000

BG Robert L. Davis
Commander
US Army Engineer Division, Pacific Ocean
Building 525
Ft. Shafter, HI 96858-5440

BG Merdith W. B. "Bo" Temple
Commander
US Army Engineer Division, North Atlantic
Fort Hamilton Military Community
301 General Lee Avenue
Brooklyn, NY 11252-6700

BG Michael J. Walsh
Commander
US Army Engineer Division, South Atlantic
60 Forsyth Street, SW, Room 9M15
Atlanta, GA 30303-8801

Dr. Billy L. Edge
Ocean Engineering Program
Department of Civil Engineering
Texas A&M University
College Station, TX 77843-3136

Dr. Joan Oltman-Shay
Northwest Research Associates
14508 NE 20th Street
Bellevue, WA 98009-3713

Dr. R. Bruce Taylor
Taylor Engineering, Inc.
9000 Cypress Green Drive, Suite 200
Jacksonville, FL 32256

Colonel James R. Rowan, Executive Secretary
Commander
US Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Opening Remarks and Welcome

COL James R. Rowan, Executive Secretary of the Coastal Engineering Research Board (CERB), called the 79th meeting of CERB to order Board members and participants to the meeting. He thanked all involved in the arrangements of the meeting and thanked the Pacific Ocean Division (POD), especially Alaska District, for hosting the meeting and providing an enlightening trip to Nome, AK, the previous day for the Board members.

MG Don T. Riley explained to the audience that CERB was established by Public Law in November of 1963 and functions as an advisory board to the Chief of Engineers, providing advice and guidance for the conduct of research and development in the field of coastal engineering. He introduced the Board members and welcomed all participants to the meeting.

MG Riley stated that the CERB meeting is a public meeting, and as prescribed by Public Law, 30 minutes is set aside for public comment.

MG Riley emphasized the goal of the meeting, which is to review the coastal engineering challenges of the Pacific Ocean Division in general and the Alaska District, in particular, within the context of the Corps' Civil Works Strategic Plan, the report of the Commission on U.S. Ocean Policy and the President's Ocean Action Plan. The objectives are to 1) ascertain the degree of collaboration between the Alaska District and other Federal agencies in addressing coastal engineering challenges and barriers to preventing greater collaboration; 2) review Alaska District's lessons learned, but more so their successes and challenges in planning and implementing the coastal ocean observing system; 3) determine Pacific Ocean's and Alaska District's unmet needs for coastal engineering models and scientific data; and 4) review the taskings of the Chief of Engineers in regard to the preparation for future tsunamis in the POD area of responsibility, coastal erosion in Hawaii and Alaska, socioeconomic impacts of climate change on the native Alaskan communities, and navigation project design, construction, and maintenance.

BG Robert L. Davis welcomed all participants and attendees to the Pacific Ocean Division, headquartered in Honolulu, HI. BG Davis stated that statistically POD is the most northern, southern, and western Division in the Corps of Engineers, including the Alaska District, Honolulu District, which includes the South Pacific islands, Japan District, and Korea District. CERB was planning to meet in Hawaii, but with the coastal challenges facing Alaska, especially significant issues on coastal erosion and native Alaskan villages pointed out by Senator Ted Stevens, it was determined that Alaska would be the place to host the CERB meeting and give the Board members an opportunity to view these coastal challenges firsthand. Alaskan communities are linked by small harbors and by airfields, so they have coastal transportation issues as well as coastal erosion issues, as we saw in our trip to Nome. We saw firsthand the transportation issues, as we were unable to fly into Shishmaref as planned.

COL Timothy J. Gallagher, Commander of the Alaska District, also welcomed all participants to the 79th CERB meeting. He explained that the coastal engineering challenges in Alaska are many, diverse, and very significant. There is a complex system of harbors and channels in all areas including the southeast, the Arctic, and the Aleutians, increasing demands for recreation and the growing number of cruise ships and commercial fishing fleets constantly trying to adapt to the constantly changing market demands.

The most pressing issue is the accelerated erosion along much of the coastline. There has been less sea ice in recent years, coming later in the year, causing much more erosion during the fall storm season and impacting many of the native Alaskan villages by loss of land and buildings.

COL Gallagher stated that CERB would be hearing from experts in the field of climate change, coastal processes and cultural impacts, as well as from representatives of two villages to learn about their experiences and the challenges they are facing.

This CERB meeting has helped the Alaska District establish a relationship with the Alaska Ocean Observation System and the Arctic Research Commission, strengthening each other's efforts by sharing resources and knowledge.

CERB would also be hearing from some of the Alaska District partners at the Port of Anchorage and how they are working together to expand their facilities and collaborating on the ever-changing sedimentation on the Cook Inlet.

With the disastrous tsunami last year, we are taking this opportunity to have the West Coast and Alaska Tsunami Warning Center provide us with the presentation on tsunami activities in their area of operations.

COL Gallagher hoped the Board would learn about the challenges facing the Alaska District and give POA insight on how we can work to address these important issues.

Tsunami Warning Center Operations

Bruce W. Turner
West Coast & Alaska Tsunami Warning Center
Palmer, AK

Abstract

The West Coast & Alaska Tsunami Warning Center (WC/ATWC), as part of the National Weather Service (NWS), disseminates Tsunami Warnings based on earthquake location and magnitude to all the coastal states – now including the Atlantic and Gulf Coast states as well as the Canadian Pacific maritime province of British Columbia. Approximately 170 channels of seismic data and 240 channels of water level data are monitored in real-time to evaluate earthquakes and forecast potential tsunamis for both coasts. Watch and warning messages are automatically composed based on a reviewed earthquake solution and transmitted over NWS communications systems within 5 to 15 minutes of the earthquake. WC/ATWC and the NWS, in partnership with State Emergency Managers, conduct outreach activities – giving tsunami preparedness presentations to coastal communities, city officials as well as schools, and local planning commissions.

Discussion

MG Don T. Riley asked what type of general partnership activities did the Tsunami Warning Center Operations have with the U.S. Army Corps of Engineers, other Federal agencies, and the state. *Mr. Turner* responded there were none that he was aware of, but they could use some, especially in respect to tide gauges.

MG Riley asked if all the instrumentation belonged to the Center or if they were tapped in other Federal agencies. *Mr. Turner* responded that all the tide gauges, except the one located off of Shimian, are operated by the National Ocean Survey. It is a radar gauge that looks down through the water.

Dr. Billy L. Edge noted that there was no indication by the Cascadia Fault of a potential tsunami area. *Mr. Turner* explained that those stars indicated historical tsunamis. *Dr. Edge* asked about the proposed major tsunami that might occur off the coast of Los Angeles/Long Beach, which was described by the recent issue of "Civil Engineering" magazine. *Mr. Turner* said he did not read that magazine, but it certainly is a possibility, and he has seen scientific papers on that. He thought the issue would be a shelf collapse of some kind that would be generated by a large slip/strike. He continued to explain that the Atlantic Coast really does not suffer from the same kind of tsunami hazard as the Pacific Coast does. However, the one issue is that there is a huge broad continental shelf on the Atlantic side, and that area

can harbor a potential tsunami because of the large landslides that can occur, and there has been documentation of cracks that have occurred in the continental shelf. This might cause a large tsunami in the Los Angeles area. Wherever there are earthquakes, it is possible.

BG Merdith W. B. Temple noticed that there were not many monitoring stations in Mexico, and he was wondering if the reason for that was because events in Mexico are not likely to cause a tsunami. *Mr. Turner* said that there is definitely a potential for a tsunami off the coast of Mexico. There is a subduction zone in Central America that would be of concern. He reminded the Board that they were the West Coast and Alaska Tsunami Warning Center, and that the areas in Mexico did not fall under their area of responsibility, but where we have an earthquake generated off the coast of Mexico near the border, it comes within their area.

Pacific Risk Management ‘Ohana (PRiMO): A Shared Vision for Integrated Risk Management in the Pacific

Eileen L. Shea
East-West Center
Honolulu, HI

This presentation provides an opportunity to brief the Coastal Engineering Research Board on an evolving partnership designed to enhance the integration of risk management programs undertaken by Federal, State and regional organizations, scientific and technical institutions and the private sector. The Pacific Risk Management ‘Ohana (PRiMO) is a collection of representatives from local, national, and regional agencies, institutions, and organizations involved in risk management programs and activities in the Pacific. Formation of PRiMO was driven initially by the following goal:

> “a comprehensive, integrated approach to risk management that provides useful and timely information products and services that reduce vulnerability and increase resilience to immediate and long-term threats to the lives, as well as the economies and ecosystems upon which the peoples of the Pacific depend.”

In this context, risk management encompasses any action taken to reduce or eliminate risks to human life and a community’s economic, social, cultural and environmental assets due to hazards.

In March 2003, the Pacific Services Center (PSC) of the National Oceanic and Atmospheric Administration (NOAA) convened the first Roundtable of Federal Mitigation Partners in the Pacific Islands in Honolulu, HI. This meeting brought together representatives from local, national, and regional agencies, institutions, and organizations involved in risk management programs and activities in the Pacific. The purpose of the meeting was to explore opportunities to enhance communication, coordination and collaboration within this ‘ohana (family) of risk management partners. Following two days of information sharing and discussion, the participants asked NOAA/PSC to convene a second meeting of the Roundtable in 2004 and, in the interim, to begin to explore the value of a more systematic approach to coordination, collaboration, and, ultimately, joint initiatives in the area of risk management in and for Pacific Island communities.

The March 2004 Roundtable focused on the development of a conceptual framework for interagency communication and coordination and the organization of a set of *hui o hana* (working groups) that would help guide the development of both individual activities and a joint regional action plan. The Action Plan is a dynamic, living plan that recognizes the need to serve both short-term response needs and long-term planning requirements and addresses issues in three risk management problem areas:

- Seismic, volcanic and tsunami

- Climate and weather and
- Human-induced risks

The PRiMO *hui o hana* are the "paddles" that move these individual risk management canoes forward through coordinated efforts in the areas of:

- Observations and Data/Information Management;
- Decision Support Tools;
- Communication, Education and Outreach, including a specific focus on communications infrastructure needs in the Pacific as well as broader education, training, and public outreach activities;
- Post-disaster Evaluation and Performance Indicators; and
- Traditional Knowledge and Practices.

The work of the PRiMO *hui o hana* is overseen by a coordinating council of "navigators" drawn from key partner agencies that have expressed a willingness to commit resources (human and financial) and time to support the emergence of a truly collaborative effort characterized by shared risk, shared resources, and shared recognition. Current membership on the Navigators Council includes: NOAA, the Corps of Engineers, the Federal Emergency Management Agency, U.S. Geological Survey, and other representatives of the Department of the Interior, the Environmental Protection Agency, the University of Hawaii, and the East-West Center. While PRiMO initially focused on risk management programs and needs in Pacific Island jurisdictions, we are hopeful that PRiMO can expand to include broader Pacific interests, challenges, opportunities and, most importantly, partners.

Today, the PRiMO partners share a vision of "an informed and inspired Pacific community that has a comprehensive understanding of natural as well as human-induced risks, uses best thinking and best practices, and through shared resources, makes the best social and economic decisions," and have committed themselves to PRiMO as a joint endeavor to enhance communication, coordination, and collaboration among a network of partners and stakeholders involved in the development, delivery, and use of risk-management information products and services in the Pacific. Specific, near-term *Strategic Activities* include:

- Sustain dialogue and enhance communication among risk management partners and deepen the sense of partnership;
- Coordinate data collection and data sharing regionally (e.g., use of the Asia Pacific Natural Hazards Information Network (APNHIN) managed by the Pacific Disaster Center to support PRiMO's data catalog, search, access, and sharing needs);
- Co-create and distribute data support tools (e.g., GIS, post-disaster data collection tools, development of performance measures); and

- Work for synergy in education and training programs.

During the March 2005 PRiMO meeting in Kona, HI, the PRiMO partners acknowledged the potential value of a near-term opportunity to demonstrate the value of PRiMO as a regional focal point for risk management program design and implementation. That opportunity arose in the context of Senate deliberation of S. 50, the U.S. Tsunami Preparedness Act, and could provide an opportunity to broaden the PRiMO partnership to include other Pacific regional partners such as our colleagues in Alaska, the Pacific Northwest, and California. I was invited to testify at the Senate Commerce Committee's February 2 hearing on S. 50 by Senator Inouye and focused on the importance of building an effective risk management information system nationally, regionally, and globally. My testimony took note of the "enhanced level of collaboration represented by PRiMO" and noted that this partnership "helps put the Pacific in a strong position to take advantage of new technological capabilities and support the emergence of a comprehensive risk management information system in the region. As a result of the February 2 hearing and subsequent Committee deliberations, the version of S. 50 currently under consideration by the Senate includes a new Section 8 calling on NOAA to establish an "integrated Coastal Community Vulnerability and Adaptation Program focused on improving the resilience of coastal communities to natural hazards and disasters." S. 50 indicates that this program should be regional in nature, build upon and integrate existing Federal and state programs, and provide useful products to improve the preparedness of communities, businesses, and government entities. As described in Section 8 of S.50, this Coastal Community Vulnerability and Adaptation Program would include:

- Multi-hazard vulnerability mapping;
- Multi-disciplinary vulnerability assessment, research and education;
- Risk management leadership training;
- Risk assessment technology development;
- Risk management data and information services; and
- Risk communication systems.

According to S. 50, "priority shall be given to collaborative partnership proposals from regionally-based multi-organizational coalitions" and the PRiMO partners are prepared to develop a proposal once S.50 is enacted. It is our hope that we can develop that proposal in collaboration with partners in other parts of the Pacific who might also be considering development of similar proposals (e.g., in Alaska).

(There was no discussion following this presentation.)

Alaska Modeling and Data Issues

Bruce A. Ebersole
Chief, Flood and Storm Protection Division
Coastal and Hydraulics Laboratory
U.S. Army Engineer Research and Development Center
Vicksburg, MS

The U.S. Army Engineer Research and Development Center's Coastal and Hydraulics Laboratory staff has supported the U.S. Army Corps of Engineers' Alaska District on a number of projects that have challenged the Corps' coastal engineering and modeling/simulation capabilities. These applications have "stretched" the technology in some cases, but they have led to improved capability in all cases. Many factors render engineering in Alaska a complex and challenging endeavor. These include: the changing nature of ice cover at both seasonal and long-term temporal scales; the complexity of landforms and bathymetry that characterize the Alaskan coastline and strongly influence coastal processes; spatial variations and complexity of the astronomical tide, the extreme tide range in places, and changing relative dominance of wind- and tide-driven hydrodynamics; uncertainties in the regional-scale ocean circulation patterns in the Arctic region; and the complex sediment and morphology environment, including great uncertainty in sediment loadings. Acquisition of data for the purposes of model development, testing, and evaluation has been a crucial factor in each of these projects, helping to reduce the uncertainty inherent in model predictions and in engineering design. Project-specific experiences have resulted in a clearer vision of needs, in terms of data collection, model development and application, and research.

Ocean- and basin-scale, deepwater wave and storm surge models were created for much of the Alaskan coast, validated using existing or recently-acquired data, and then applied to support a number of projects that included design of an expanded Delong Mountain Terminal (a zinc ore-loading facility) in the Chukchi Sea and design of a storm protection project at Barrow. The models also have been applied to provide storm wave and water level information at numerous other native Alaskan village sites along the northern and western Alaskan coasts and at several of the state's remote coastal harbors. Shallow-water wave modeling was done on a site-by-site basis. These studies have shed light on pressing needs for a variety of data.

One critical need is hydrometeorological data. Modeling highlighted a requirement for more accurate, better-resolved data with which to characterize the wind and atmospheric pressure fields throughout the open water regions. This source of data directly dictates our ability to predict growth of waves, wind-driven circulation in general, and storm surge generation in particular. Each project required improvements to available model-generated wind and pressure data products through infusion of sparse measured meteorological data. Wave measurements from short-term buoy deployments were invaluable

for “backing into” a simplified treatment of complex ice cover issues, and validating wave model predictions. A regional network of buoys in deep and intermediate-depth water, to measure wind, atmospheric pressure and coastal wave characteristics, is recommended for the Alaska coast. Another need is for shallow-water wave, water level and current data at many more coastal locations than those where data are presently available, in order to characterize local hydrodynamics during typical conditions and storms. A feasible, optimal mix of long- and short-term hydro-meteorological measurements is needed.

A comprehensive strategy for hindcasting shallow-water waves, water levels, and coastal currents is needed to aid the process of quantifying long-term changes due to climate change, and to assess implications of those changes on coastal project design and maintenance. A hindcasting approach is needed to help compensate for a lack of historic measurements. The hindcast strategy should create the maximum length of data/information record possible, to facilitate examination of historic changes to hydrodynamics that are occurring in response to changes in Arctic ice cover and changes to Pacific and Arctic Ocean storm frequency and intensity which are associated with global climate change. Systems have been, and seem to be, in place for capturing changes to evolving ice cover reasonably well, at least for the purposes of wave and circulation prediction.

Additional data and modeling are needed north of the Bering Straits to characterize astronomical tide conditions. Predictions based on existing data appear to provide conflicting and inconsistent results in this region.

The Barrow storm damage reduction project highlighted the need for data that capture beach sediment composition and storm-induced beach morphology changes at all sites where coastal erosion threatens native Alaskan villages and other infrastructure. The data are needed for model development and validation, for episodic events and to examine seasonal changes. Data to characterize the long-term background erosion/accretion trends along Alaska’s coast are needed as well. There seems to be little information describing sediment characteristics in bluffs and permafrost conditions in bluffs.

Research needs to include: improved methods for treating the effects of momentum transfer from wind into surface waves and the water column as a function of varying degrees of and character of ice cover, three-dimensional water circulation under these conditions, terrain effects on coastal winds, high currents generated during formation of leads in the ice pack, effects of ice gouging on morphology changes at beaches and on the design of shore protection structures, effects of permafrost on bluff erosion and introduction of sediments to the coast. A gravel-dominated foreshore regime is found at Barrow, and more data and research are needed to assess applicability of tools that have been derived for engineering on sandy beaches for use on gravel-dominated beaches and other complex sediment regimes.

Regional and local scale hydrodynamic modeling has been done to characterize circulation in upper Cook Inlet, as a precursor to examining extraordinary sediment infilling problems at the Port of Anchorage. The study revealed the need for continuous current measurements on shallow tidal flats throughout the spring-neap cycle, as well as data that can accurately characterize the complex three-dimensional hydrodynamics associated with strong flows past headlands and the shedding of vortices by those headlands. There is a need to acquire accurate elevation data on the massive tidal flats that characterize Cook Inlet and hold considerable water at high tide. Current predictions are sensitive to elevations on the tidal flats. There are acute needs for data to characterize the evolution of morphology features in upper Cook Inlet, much higher quality information on sediment inputs to Cook Inlet from rivers, and data on erodability, entrainment, transport, and deposition of fine sediments in response to strong tidal flows along the massive tidal flats.

There is a great need for models that can predict the complex flow and sedimentation patterns of upper Cook Inlet and the Port of Anchorage, and data sets are needed for model development and validation. The same needs apply to other harbors throughout Alaska that are characterized by fine-grained sedimentation processes, including "half-tide" harbors that are only navigable during the high water portions of the tidal cycle.

Coastal and inlet processes in Alaska are complex. They pose considerable modeling challenges; and project-specific experiences highlight the need for data collection, modeling, and research to address a range of coastal science and engineering challenges.

Discussion

Dr. Joan Oltman-Shay asked if anybody had been looking at archives of satellite SAR data for waves in the region. *Mr. Ebersole* responded that we have not looked at that.

Dr. Billy L. Edge applauded Mr. Ebersole's presentation and the work being done in the region and understood its large coastline and much data that is missing. He remembered that there was an RFP out from the National Oceanic and Atmospheric Administration to do a wetting/drying model of Cook Inlet. He was wondering if Mr. Ebersole was involved and if that was completed. *Mr. Ebersole* was not aware of it.

Dr. R. Bruce Taylor asked if he was correct in assuming that the model, as it is set up now, has basically one connection to the Polar Sea past the Bering Straits as opposed to the connectivity of the Polar Sea to the world's oceans, if you really look from the north Pole down. *Mr. Ebersole* answered, "No, when we did the original work at DMT, we looked through the literature, and we ended up imposing a small gradient on the water surface slope to drive what we believed the literature suggested was the

right kind of current speed through the Bering Straits. We did not consider other connections around the Arctic in terms of boundary conditions.

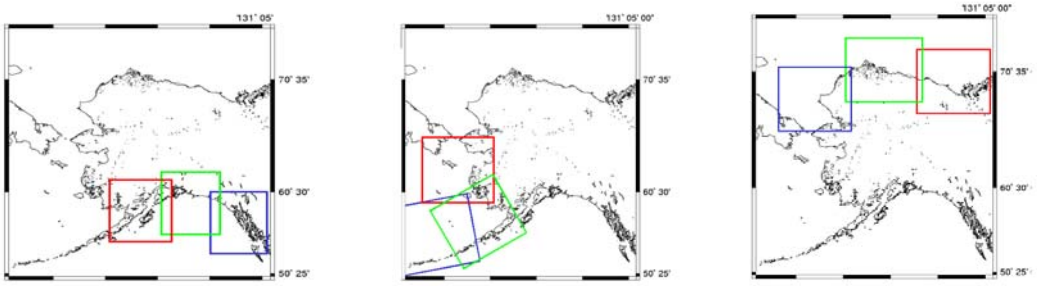
Dr. Taylor also asked if we looked at dissipative effects of ice over and how that might affect the tidal amplitude. *Mr. Ebersole* stated that it could be extremely important, but they were not able to uncover much information about that. The constituent information available gave three different answers. It is very complex up there in terms of these regional circulation patterns. If you are looking at net fluxes of water through the system, they are very important.

Mr. Douglas F. Jones asked if before you start doing three-dimensional models, would it be advisable to try to look at more tidal components in the ADCIRC model. He said, "If I am not mistaken, you use something like eight, and you can see that, as you get further into the Knik Arm, the correlation between prediction and data gets a little worse. NOAA uses about 144 components to get tidal predictions in Knik Arm." He was wondering if you tried more tidal components, it might give you another shot at it. *Mr. Ebersole* did not think so. He said we have looked at the measured data enough to realize that these motions have periods on the order of one to three hours, and they seem to be triggered by flows past these headlands. There have been analyses to convince ourselves that they are, in fact, related to these vortices and turbulences and things that are shed as these high currents race past these headlands.

Alaska Ocean Observing System

Molly McCammon
Executive Director
Alaska Ocean Observing System
Anchorage, AK

The Alaska Ocean Observing System (AOOS) is the umbrella regional association for three Alaska regional observing networks (Gulf of Alaska, Bering Sea/Aleutian Islands and Arctic) that are being developed as part of the national Integrated Ocean Observation System (IOOS) under the National Ocean Planning Partnership (NOPP) and its interagency planning office, Ocean.US.



The purpose or mission of the national IOOS – and that of AOOS – is to develop a unified, comprehensive, cost-effective approach to providing ocean observations (biological, chemical and physical) from a permanent monitoring system and developing the information products based on those observations to meet the needs of users of coastal ecosystems.

The goals of the national and the Alaska systems are to:

- Improve the safety and efficiency of marine operations;
- More effectively mitigate the effects of natural hazards;
- Improve predictions of climate change and its effects on coastal populations;
- Improve national security;
- Reduce public health risks;
- More effectively protect and restore healthy coastal marine ecosystems; and
- Enable the sustained use of marine resources.

AOOS planning and development has been underway for more than two years. The AOOS partners include all the major non-profit research institutes and entities in Alaska; the University of Alaska including its Schools of Fisheries and Ocean Sciences; the Alaska Sea Grant Program; Federal agencies; and the private sector.

AOOS is an active participant in national planning efforts for the Integrated Ocean Observing System (IOOS) and the National Federation of Regional Associations (NFRA) for Coastal and Ocean Observing. AOOS Executive Director, Molly McCammon, serves as co-chair of the NFRA. The AOOS planning efforts are closely coordinated with planning for other marine science efforts in Alaska.

Background. Alaska has nearly 47,000 miles of coastline (~ 75 percent longer than all of the other U.S. coastlines combined) bordering two oceans and the vast Bering Sea, as well as numerous sounds, inlets and bays. Alaska seas cover about 75 percent of the United States' continental shelf. Although the population of Alaska is small (about 650,000 residents), there are two overriding issues that make Alaska important from the national and international perspective. First, its coastal waters are among the most biologically productive in the world, with over 50 percent of the nation's commercial fisheries catch centered in Alaska waters. This resource – valued at over $1 billion a year - is vitally important to the national economy and food supply. And second, the impacts of global warming and consequent climate change have become readily apparent in the Arctic. As our Nation's only Arctic state, Alaska is experiencing dramatic reductions in sea ice cover, increased storm surges and coastal erosion, and changes in ecosystem productivity.

Potential Users and Benefits. The primary users of an Alaska Ocean Observing System will be

- Those concerned with Alaska's commercial fisheries – fishermen, resource managers, hatchery operators, vessel operators, weather forecasters, Coast Guard search and rescue, researchers; and
- Those concerned about climate change impacts – researchers, coastal residents, subsistence hunters and fishers, community planners, offshore oil and gas industry, and resource managers, as well as those concerned about global climate change impacts.

In addition to these primary users, there are a number of other potential users of an Alaska Ocean Observing System. These include the marine transportation system, the tourism industry, state ferries, cruise ships, managers of resources such as seabirds and marine mammals, and oil and gas developers and oil spill response.

Climate Change. The nature of all ecosystems is change, which can stem from natural and/or human induced causes. Nowhere else in the world is ecosystem change more apparent than in the Arctic, which includes much of Alaska. According to the recently released Arctic Climate Impact Assessment, the Arctic is warming more rapidly than previously known and at nearly twice the rate of the rest of the globe. In Alaska, average winter temperatures have increased as much as 4 to 7 degrees F in the past 50 years and could increase as much as 7-13 degrees F over the next 100 years. At least half of the summer sea ice in the Arctic is projected to melt by the end of this century, adding to global sea level rise. This warming could have devastating consequences for some Arctic animal species such as ice-living seals and

for local people who depend on these animals for food. Polar bears could be driven to extinction. These changes, plus increased ultraviolet radiation and expansion of the range of the West Nile virus, could pose serious challenges for the health and food security of Alaska natives.

Alaska is unique in that so many of the state's people live a subsistence way of life. For Alaska natives, subsistence is more than a means of providing food; it is the wellspring of a rich spiritual and cultural life. Alaskan natives are resident in coastal communities throughout Alaska and depend on marine resources.

Global warming is already having a severe impact on many aspects of the Alaska ecosystem and on the way of life of many of Alaska's coastal communities. One cause of the changes Alaska is experiencing is a shift in global weather patterns. This has resulted in changes in the regional features of the atmospheric, oceanic and sea ice, terrestrial systems, and the marine ecosystem. For example, storm intensity, sea state, and sea ice extent/timing are among the features whose strength and frequency will likely change throughout Alaska waters with climate change. Another manifestation of climate change is that extensive erosion of the shoreline is occurring and impacting coastal villages. Over the past few years, several communities have lost hundreds of feet of shoreline due to the winter storm surges whose severity has increased due to the greatly reduced season of shore fast ice.

Alaska Size Challenge. Given the state's geographic size, remote location and corresponding logistical challenges of placing and maintaining instrumentation, as well as the diversity of its user groups and needs, planning and development of an overall system for the entire state of Alaska is a challenge. Despite its tremendous marine resources, Alaska has a dearth of existing observing platforms and stations. Therefore, a major goal of AOOS is to expand and enhance existing observing capacity, through enhancements to the national backbone of observing platforms, and through additions to capacity in the three regions in Alaska: the Arctic, Bering Sea/Aleutian Islands and Gulf of Alaska.

Prince William Sound has been selected as the system's pilot project for developing a comprehensive system and products such as circulation, atmospheric and wave models for users. A statewide Data, Modeling and Analysis Group is being established at the University of Alaska Fairbanks to provide the data integration and product development capacity for users of the observing system. Future plans include expansion in the Bering Sea and Arctic regions, as well as Cook Inlet, Kodiak and southeast Alaska.

This presentation will describe current and planned efforts to develop the AOOS in response to user identified needs for coastal and ocean observing.

Discussion

Dr. Joan Oltman-Shay mentioned that she had been involved with IOOS since its beginnings and had watched IOOS identify its backbone and regional associations identify their needs. She noted that Ms. McCammon mentioned nearshore forecasting as being a priority and identified stakeholder need of coastal erosion, and under the coastal erosion header, she noted wave height. *Dr. Oltman-Shay* wondered if it was understood in Ms. McCammon's community that wave direction is really what is needed to address that question, and not just height, and that, in addition, under observations, data and modeling, that wave propagation information is also valued. She also wondered if when Ms. McCommon said your high priorities in infrastructure, she added buoys, which she agreed, but wondered if the buoys have direction. *Ms. McCammon* responded that they did. Wave direction is definitely a part of it. She stated that one of the things that the National Data Buoy Center did with their national IOOS money this year was go back to the regions and ask for priorities to add wave directional sensors to the existing buoys and to start prioritizing those. She believed they were getting two that were going to be enhanced with some of that funding.

Dr. Billy L. Edge stated that Ms. McCammon mentioned high-frequency radar at pulse points in the circulation and wanted some clarification. *Ms. McCammon* answered that a pulse point would be a place like the Bering Strait, which is a key area of the circulation of the Bering Sea. It is very narrow at that point so there is a considerable amount of current going through. It is something that a surface current mapper, which is located on shore, and it is a radar that goes offshore. You would be able to map that entire point.

Dr. Edge stated that he did not see anything at all about satellite measurements or any use of satellite information. He stated that he may have missed it. *Ms. McCammon* stated that it was mentioned, but they have to figure out how to do it. She stated that one way they are addressing the satellite issue is at the data and modeling group, one full-time person will be taking satellite data and then developing it into products for users. Another way is working with the Arctic Research Commission and looking at sea ice and satellite monitoring of sea ice and trying to determine what kind of improved products are needed. It will definitely be a component. *Ms. McCammon* mentioned that Cook Inlet is really a good example of how a program like that could work. AOOS had a workshop in Homer, AK, to look at the physical oceanography needs for Cook Inlet. It was discovered that there were four ocean circulation models currently being funded and ongoing, two by the National Oceanic and Atmospheric Administration, one by the U.S. Army Corps of Engineers, and one by Minerals Management Service, all different models and for different purposes, but they all had much in common. Their next big goal is to get the modelers together to really look at those models and see where the big gaps are and what kinds of observations and modeling systems could meet the needs of all the models.

Dr. Oltman-Shay added that Ms. McCammon mentioned cabled observatories on Little Diomede and the Pribilofs and asked if she could expand on that. *Ms. McCammon* responded that as part of the ocean observing program, National Science Foundation (NSF) is also committing to a whole program of ocean observations and looking longer-term out to 25 or 30 years. They are looking at establishing a system of cabled observatories where you have a cable going offshore that powers instruments. You can use autonomous underwater vehicles or other things to intensively monitor some area of key interest, so we chose certain intensive sites across the country and do more intensive observations there that answers more of the process questions and some more of the detailed questions.

Ms. Joan Pope commented that the area in which they were located abuts a lot of international waters. She was wondering if they had any collaboration with Canada on some of the data collections and how they are interfacing with them. *Ms. McCammon* said that they had been collaborating with the monitor committee of the North Pacific Science Association, which includes the United States, Canada, Japan, Russia, and Korea, looking at some of these larger-scale issues and the kinds of monitoring that is being done in Canada. On the Arctic Basin portion of it, *Ms. McCammon* stated that she was serving on a National Research Council committee developing an Arctic Observing Network of which one of the goals is to try to identify what a basic observation system is that would meet one of those larger-scale needs and also some of the more regional needs.

Pacific Islands Integrated Ocean Observing System (PacIOOS): Building a Foundation

Eileen L. Shea
East-West Center
Honolulu, HI

This presentation provides an opportunity to brief the Coastal Engineering Research Board on a new effort to establish a Pacific Islands Regional ocean observing program as part of the U.S. Integrated Ocean Observing System (IOOS) program. The U.S. IOOS program represents the U.S. contribution to the multinational Global Ocean Observing System that, in turn, represents one of the system contributions to the emerging multi-national Global Earth Observing System of Systems (GEOSS) that the United States is leading.

As described in IOOS program documentation, the U.S. Integrated Ocean Observing System will be "a sustained network of "eyes" on buoys, ships, satellites, underwater vehicles, and other platforms that routinely supply the data and information needed for rapid detection and timely predictions of changes in our Nation's coastal waters and on the high seas." The U.S. IOOS program comprises three interacting and mutually-supportive elements:

- A **global** component including large-scale ocean observing systems such as the Tropical Atmosphere-Ocean (TAO) array of moored buoys in the Pacific that provide the climate observation foundation for forecasts of El Niño;
- A **'national backbone'** consisting of a network of existing and enhanced Federal assets that make routine observations in the U.S. Exclusive Economic Zone (EEZ) that are critical for weather forecasting and warnings, safe navigation, and resource management; and
- A set of **'nested regional observing systems'** designed to supplement the global and national backbone components of IOOS with observations, data, information services, and education programs focused on addressing critical regional issues.

The emerging Pacific Islands IOOS (PacIOOS) program, like the Alaska Ocean Observing System (AOOS), represents one of these regional programs. Geographic coverage of the PacIOOS program includes the American Flag Pacific Islands (Hawaii, Guam, Commonwealth of the Northern Mariana Islands, and American Samoa) and the U.S.-Affiliated Pacific Islands (Federated States of Micronesia, Republic of Palau, and Republic of the Marshall Islands).

A number of past and ongoing activities laid the foundation for the PacIOOS program including:

- A history of observational programs and activities that contribute to ocean observing systems on the global, national, and regional scale, particularly at the University of Hawaii including

contributions to studies of climate variability, the carbon cycle, weather-related extreme events, coral reef ecosystems, and fisheries;

- Development of a Pacific Risk Management Ohana (PRiMO) that included discussions of ocean and coastal observational needs to support risk management programs in the Pacific region;
- Multinational discussions in the region regarding the societal benefits of ocean observations for Pacific Islands and a call for a region-wide Pacific Ocean Information System; and, in that context;
- Support for the emergence of Pacific Island contributions to the Global Climate Observing System (PI-GCOS) and the Global Ocean Observing System (PI-GOOS).

As is the case with AOOS and other regional programs, PacIOOS will be problem-focused and reflect a participatory process involving a partnership among the providers and users of information and services derived from ocean observations. PacIOOS will be an integrated program involving:

- Enhancements to regional and local observing systems;
- Data assimilation, analysis, modeling, and assessment;
- Data communications and information management;
- Technology development, including pilot/demonstration projects;
- Education and training; and
- Continuous, interactive dialogue with decision-makers and other key stakeholders.

Priority will be given to three thematic areas: Preserving healthy marine and coastal ecosystems and resources; predicting weather and climate and supporting adaptation to climate variability and change; mitigating hazards (risk management), including issues related to coastal erosion.

Initial funding for PacIOOS (and other regional programs) is limited so the first three years of PacIOOS activities will focus on the following critical tasks:

- Engaging the providers and users of products and services derived from ocean observations in an effective partnership to identify information needs and design, evaluate, and apply PacIOOS information and services;
- Assessing the state of regional observing systems and identify critical gaps in light of those information needs; and
- Establishment of a PacIOOS Regional Association that will provide the institutional, fiscal, and administrative governance mechanism for the program.

In addition, we hope to establish early links to other regional IOOS programs – most notably AOOS – to address shared problems such as coastal erosion, extreme events such as coastal storms and

high wave events (including tsunamis), and climate-related issues such as sea level rise and adaptation to climate variability and change.

Discussion

MG Don T. Riley stated that it is clear that we will look at the different states working with the Federal government as well. We will need to ensure that we have good coordination across our District and Division boundaries as we work the IOOS and certainly with each one of the states.

Dr. Joan Oltman-Shay asked what was the mix of Federal, state, local stakeholder, and academia on their leadership council. *Ms. Shea* answered that it depended upon the topic. In the climate arena, the mix is about two-thirds stakeholders, and one-third scientists. The mix there is largely national level in the other jurisdictions, on down to village level, in which representatives are chosen. There may be a village elder who is the respected source of information on weather conditions, rainfall, wind, and erosion, then that is the person brought in. In terms of what is happening in the PacIOOS, it is 70 percent Federal agencies. *Dr. Oltman-Shay* asked to clarify that their academics are more in both the support role and also probably recipient stakeholders themselves of the benefits. *Ms. Shea* agreed.

Mr. Stanley J. Boc asked what was the Federal role in the regional associations, what are the obstacles for Federal participation, and what are the plans to overcome those obstacles? *Ms. Shea* answered that there were no obstacles that could not be overcome. The Federal agencies are full partners in the design, the implementation, the use of IOOS, and its evaluation down the road. One of the obstacles that has been highlighted with little spotlights saying, "Oh, but isn't it a conflict of interest to have a Federal agency serve on a governing board for a regional observing system if it means committing that agency's resources?" *Ms. Shea* continued to state that Ms. McCammon mentioned that one of the things that is happening at the national level is the inclusion of a simple sentence or two in the authorizing legislation that will say that they can fully participate as members of a regional program. Another way is to describe in practical terms what you want a Federal agency to do at the regional level, and once that is laid out, as long as it is consistent with the mission of that agency, the legal issues are going to fall by the wayside. *Ms. Shea* also mentioned that one of the obstacles is flat time. This takes time, energy, and human resources. An agency, a scientific institution, or an individual scientist committed to this must make a decision as to how much time is going to be spent working this problem. Also, that is something that is not often appreciated and rewarded.

Honolulu District Coastal Research and Development Needs

Thomas D. Smith, P.E.
Coastal Engineer
Civil Works Technical Branch
Engineering and Construction Division
U.S. Army Engineer District, Honolulu
Honolulu, HI

The Honolulu District of the Pacific Ocean Division (POH) is the U.S. Army Corps of Engineers' (USACE) largest district by area and smallest by land mass. POH's area of operations includes the state of Hawaii, American Samoa, Guam and the Commonwealth of the Northern Marianas Islands. Federally authorized storm damage reduction (SDR) and navigation projects comprise a significant portion of the district's civil works program. Federal deep- and shallow-draft navigation projects provide vital commercial, subsistence and recreational infrastructure for these remote Pacific Ocean island communities. POH's storm damage reduction projects typically result in hardening of problem area shorelines due to the high cost and scarcity of beach quality sand. Annual inspection of general navigation features and storm damage reduction projects is conducted through the Operation and Maintenance and Project Condition Survey (PCS) programs, respectively. POH research and development (R&D) needs to be discussed herein include: 1) field review, 2) virtual inspection of structures and 3) investigation of Hawaii beach sand issues.

Of primary concern to POH and other coastal districts in general, is the current state of field review of Coastal and Hydraulics Laboratory (CHL) related R&D activities. The past scenario incorporated annual Field Review Group (FRG) meetings at which ending and existing work unit status was presented and reviewed. This provided the FRG an opportunity to ensure ending work unit product delivery and redirection of existing work unit activities as necessary. New work units were presented by proposing principle investigators and prioritized by the FRG. This process was successful in providing Headquarters, USACE and CHL field input for final prioritization of work unit funding. The current scenario of field review of SDR and navigation project related R&D activities on the other hand is not well defined. USACE 2012 establishes Communities of Practice (COP) for various business areas including the Hydraulics, Hydrology and Coastal (HH&C) COP. Under USACE 2012, field review of SDR and navigation R&D could potentially be carried out by technical committees sanctioned within the HH&C COP and/or the Coastal SubCOP. Timely redeployment of an effective field review program is necessary to allow requisite incorporation of field needs into CHL work unit activities to optimize the utility of subsequent deliverables.

Virtual inspection of SDR and navigation project features has been suggested as one method of enhancing USACE's operation and maintenance program while providing potential cost savings. POH currently conducts annual field inspection of each of its civil works structures. These inspections consist of walking surveys complemented by annotated PCS reports. The reports are augmented on an as needed basis with acquisition of topographic and/or hydrographic surveys. Structure walking surveys are often tedious and time consuming and may provide only qualitative assessment of rehabilitation priorities and requirements. Virtual inspection of these structures through the analysis of digital data sets promises to improve documentation of structure performance and quantify extent and severity of structure damage over time.

Multibeam sonar and high-resolution LIDAR data sets were recently acquired for the Hilo Harbor breakwater as a first step in evaluating potential virtual inspection techniques as they apply to the POH civil works program. Hilo Harbor is on the island of Hawaii. The Hilo Harbor breakwater is approximately 2 miles long and it takes a two-person team nearly seven hours to conduct a detailed walking survey of the structure. The multibeam sonar data set was acquired through funding from the Geospatial R&D program funding in fiscal year 2004. Following the demise of Geospatial R&D work units, the above-water portion of the structure was surveyed via high-resolution corridor LIDAR mapping techniques. Acquisition of the LIDAR data set was funded through the CHL Periodic Inspection work unit. The data sets were merged at the Topographic Engineering Center (TEC). Fly-through movies of the digital terrain model and draped imagery generated by TEC provide insight on the utility of the merged data sets. Data acquisition, visualization, analysis and damage quantification techniques need to be advanced through dedicated R&D work units in order to realize the value added of these and other emerging technologies.

Hawaii beach sand (onekaha) is a unique, scarce and precious resource. It is composed of coralline algae, mollusk remains, coral fragments, foraminifera skeletons, sponge spicules, sea urchin spines, bryozoan skeletons, and sea shell fragments. The beach sand is produced through mechanical abrasion of its constituents and in some cases by biological means such as direct mastication of coral by parrot fish. In some instances, black sand beaches form as a result of molten lava shattering as it cools rapidly upon contact with the ocean. Offshore deposits of beach sand within POH are generally found on submerged terraces that formed during ages of lower sea level relative to the present. The deposits are elongate parallel to reef fronts and connect landward as sediment filled drowned river channels that cross the modern nearshore shelf. From a coastal engineering perspective, the deposits are attractive because of their predominantly carbonate composition, similar to existing beaches. In Kailua Bay on the windward side of Oahu, the reef-front deposit has a relatively simple and basic form. The deposit thins irregularly in the offshore direction and more smoothly parallel to the reef front. There are many analogous deposits

around Oahu, but effectively utilizing them as a source of beach fill has proven difficult both technically and environmentally. Manufacturing beach quality sand for Hawaiian beaches has shown potential, but has proven to be problematic to implement. In the past, coral fragments have been crushed to create beach fill. Once in place, the material has a tendency to cement into cobble-sized rocks that are detrimental to beach recreation activities. Even some upland sand sources have exhibited cementing tendencies when placed on the beach. Generally, upland beach fill material that is worked by waves and currents does not cement, but if the material is placed above the swash zone it oftentimes will cement in place. Given these facts, the cost to place suitable material on the beaches within POH is nominally $50 per cu yd. This cost estimate is always qualified by the fact that beach quality sand may not be available for any particular project area. R&D pertaining to these and other related challenges of island-style nourishment is needed in order to effectively and economically maintain priceless beach resources.

Other POH research and development needs to be presented include improved hurricane inundation modeling capabilities, wave rehindcast for the Pacific Ocean under the Wave Information Study, improved dynamic revetment design guidance, and inclusion of Pacific Ocean Division in the Coastal Mapping Program.

Discussion

Dr. R. Bruce Taylor stated that there is a need for adequate WIS hindcasting in the Pacific. He said he hoped we find a way to get this done so that the engineers working in the trenches get the data that they need. He added that it is a critical element in any design exercise.

Dr. Taylor asked a question concerning the condition surveys and moving forward from that point after you have taken the survey. He asked Mr. Smith to enlighten them, given the state of technology now, as to the process by which they make a determination whether or not remedial action is required or not. If so, how is that decision implemented? *Mr. Smith* answered that it is an ad hoc process. They get annual reports for each structure every year; they review what structure is in the most need of immediate attention, and then look at the budget process 2 or 3 years out, one year for plans and specs and another year for funding. But, there is no real systematic way to identify priorities. We do it by experience. *Dr. Taylor* asked if they were looking for some better technical guidance as well to help them through the process. *Mr. Smith* answered, “Right, like multiple cross sections, looking over years at how much change you have had, some guidance on how to prioritize the rehab.” He added that it is not just totally qualitative, but it is not real rigorous on how they pinpoint rehab. He also added that Hilo breakwater could probably take their budget up for the next 20 years, if they are just going to do that. *Dr. Taylor* added that maintaining structures for the long term is a pretty significant problem that we face. Some major structures on the Northwest Pacific coast as well as Hawaii are also badly deteriorated, and

we don't have the means to reconstitute them, and it is important that we be able to deal with this and maintain these properly.

BG Robert L. Davis wondered that as we do annual inspections of every one of our structures, and as we have done this for a long time, do we have any data where we could take some risk in not inspecting a structure every year that showed very little change. Perhaps we could inspect it every second, third, or fourth year, and roll that money into maintenance, and put it elsewhere with constrained resources. He added that perhaps the R&D community could help with what is an appropriate inspection schedule. *Mr. Smith* noted that it is not a big pot of money and may not get any additional rehab.

Dr. Joan Oltman-Shay said that Mr. Smith talked about searching offshore for sand deposits and potentially dredging sand deposits offshore for beach renourishment. She mentioned that Minerals Management Services has a whole work unit devoted towards modeling the effects of offshore mining of sandbars and the hydrodynamic effects inshore, waves and current changes due to the change in topography and bathymetry. She asked if that was under consideration whenever there is consideration dredging up some offshore sand sources. *Mr. Smith* answered that that would have to be part of any of the coordination of a project that has offshore dredging. You would have to show some modeling or some cause and effect on if you do dredge in 30 ft of water, within 2,000 ft of shoreline, and what are the impacts as far as wave transformation and if it would change the sediment budget at that point.

Dr. Oltman-Shay asked if there has been any research or is there any understanding knowledge as to why sand cements when you are going upland for sources there or crushing coral. *Mr. Smith* said that one though is that it does not have the coating of amino acids that it naturally has when it is generated in the water. *Dr. Oltman-Shay* asked if there had been consideration of not worrying about the cementation, such as instead of trying to put the sand on the beach, put it offshore as an offshore, nearshore sandbar, to serve as temporary protection until it is naturally eroded away and possibly coated through that process of proving an offshore, nearshore sand source? *Mr. Smith* said that in Hawaii, the issue is that you are going to be burying reef, and the Department of Health is not going to permit that kind of action. If you propose a beach project, you have to show that the material is not going to end up going offshore to any extent.

Dr. Billy L. Edge stated that when Mr. Smith was in the Jacksonville District, he was in the hotbed of coastal engineering development and expertise. He wondered if he felt isolated and cut off or had any constraints in the Honolulu District and would it be appropriate to think in terms of increasing dissemination by telecommunication, vis-à-vis webinars and televised seminars out of the Coastal and Hydraulics Laboratory or other sources, such as universities. *Mr. Smith* noted that there is a whole different mindset in Hawaii because there are not many examples of beach nourishment in Hawaii. He agreed that it is the resource agencies that needed some outreach.

Dr. Michael J. O'Connor asked if they had talked to the people at the Topographic Engineering Center about using some of the improvised explosive device change detection methodology, Buckeye High Resolution Imagery, for their visual inspection program. *Mr. Smith* said he had not and asked if it was real high resolution. *Dr. O'Connor* answered 4-inch and that he might want to consider it.

Dr. Orson P. Smith asked what the effects of tsunamis have been on the Hilo breakwater. *Mr. Smith* answered that there was some repair done after the large event there, but it did not cause a huge breach. He added that many times a tsunami will actually go over and ride over the top and crest these structures, and there will not be as much damage as envisioned.

Dr. James P. Selegean echoed Mr. Smith's thoughts on the value of program reviews, as that used to be the one opportunity for those in the field to see what sort of modeling tools and other products were coming out of the Engineer Research and Development Center and to provide feedback on and some guidance and direction on where these tools should be going. That link does not seem to be there anymore.

Mr. Russell Boudreau commented that he really liked Mr. Smith's idea of the dynamic revetment. In Hawaii and California there is a real concern about hardening the shorelines, and they have had some success in Ventura, CA, using a cobbled dynamic revetment, which is just a natural littoral material and more stable than sand. The idea of cobble, like cobble fragments, would be a good idea for a dynamic revetment material that could be found perhaps in stream ends; however, there may be some issues with the Department of Health putting that material back on the beach, but he liked the idea because it is a littoral material. Over time, it will abrade and basically go back into the system. *Mr. Smith* said that on the island of Aunu'u in American Samoa, they came upon the perfect example of a dynamic revetment. It had beach rock at the toe, the perfect slope of coral fragments, and it was much better than putting out tribars everywhere.

Climate Change Impacts on the Alaska Coastline

Dr. Orson P. Smith, PE
Professor of Civil Engineering
University of Alaska Anchorage
Anchorage, AK

Alaska's long coastline will endure stronger effects of global warming than most other marine environments of the world. Climate change has not been uniform. More warming has occurred in Alaska than in any other U.S. state or territory. Global circulation models and other simulations of future climate consistently predict a focus of warming in Alaska. Delicate Arctic and sub-Arctic ecologies are upset and the state's infrastructure shows the impact of changing climate. Impacts occur now that warrant Federal attention.

A group of 100 Alaska engineers, business managers, and agency specialists met at the University of Alaska Anchorage in January 2000 to discuss impacts of the warming world on Alaska infrastructure. Subsequent meetings have refined these initial discussions with a common thread of understanding. Global warming has caused glaciers to retreat for centuries, but has accelerated in recent decades. Most Alaskan engineers have dealt with consequences of warming climate for their entire careers. A respectable toolkit of solutions exists to deal with warming impacts on northern engineering works. Arctic engineers have options for response, but call for more extensive environmental data records to apply toward design criteria in a changing climate.

The Alaska coast is sparsely developed and populated by the standards of the lower 48, but familiar trends begin to appear in south central Alaska where the state's small population is concentrated. Commercial and private developments on the coast of the Kenai Peninsula are experiencing disappointing and expensive misjudgments of coastal construction in spite of conscientious Federal and state regulation. Glacially deposited bluff shorelines along Cook Inlet are particularly vulnerable to episodes of dramatic retreat with sea level rise and changing wave climate. Awareness grows among regional leaders that more intensive community planning of coastal developments is necessary.

The most reported of Alaska coastal erosion concerns tend to be isolated Arctic communities such as Shishmaref and Kivalina. These communities are located on ground naturally vulnerable to coastal erosion even without global warming. On their own scale, they repeat unlucky trends of shoreline development in the lower 48. Population growth at many isolated rural sites in Alaska strains the abilities of public agencies to provide for human health with safe water supply and waste disposal and for affordable housing and community facilities on stable ground. Moving entire villages has been discussed with reluctance for 20 years or more. Abandoning villages in favor of safer, more established

communities elsewhere is usually not considered in the light of powerful cultural constraints. As a result, massive coastal works are on the drawing board beside village relocations that make saving the Cape Hatteras Lighthouse seem a trivial expense.

A body of worthy research on Arctic coastal dynamics grows with international attention to the plight of communities like Shishmaref. The international Arctic Coastal Dynamics Program has designated Barrow as a research focus area among others around the Arctic Ocean basin. Questions of thaw subsidence and other permafrost-melting impacts due to global warming are being addressed, as are impacts of changing wave and storm surge climate associated with diminishing ice cover. Much work remains for findings to be efficiently applicable to coastal development issues. Wind, wave, and water level data sites are scattered and typically have short records for design criteria development.

Global warming is changing the hydrology of the interior. Newly thawed drainage basins are supplying heavier sediment loads in streams that clog culverts and bridge openings. As these sediments reach the sea, the balance of wave- and current-regulated supply and demand along the coast also changes. Alaska's littoral cells are not mapped and coastal sediment budgets are unknown. A multi-agency program to identify littoral cells and quantify coastal sediment budgets would lay groundwork for objective prediction of and measured response to climate change impacts. Such programs involving the U.S. Geological Survey, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Army Corps of Engineers are underway in other coastal states.

An opportunity exists to extend coastal research to help pending coastal development issues in the state. The south central region has exceptionally high tide ranges and strong tidal currents that affect wave-induced sediment transport in ways that are challenging to quantify. Even with sophisticated simulations, guidance for design of conventional coastal works in this setting, such as revetments, seawalls, groins, and beach fills, is sketchy in the Coastal Engineering Manual or other specialized publications.

Many more future coastal works will be planned, designed, and constructed with only regulatory oversight by the Corps. Alaskan agencies and commercial developers generally prefer to hire engineers with extensive experience and licenses to practice in the state. Specialized coastal training remains rare in the Alaska engineering community. A graduate program in port and coastal engineering at the University of Alaska Anchorage has led to the award of one to two Master of Science degrees for the last 6 years since the program's inception. The Cold Regions Research and Engineering Laboratory is already a participant in the University of Alaska Anchorage Arctic Engineering program through an educational partnership created in June 2000. The Federal government, with Corps leadership, could help train Alaska engineers in the specialty of coastal engineering using modern distance education technology. A better-trained regional engineering community will prevent many mistakes of the past.

A need also exists to inform community leaders, agency decision-makers, and the general public of the specialized challenges of coastal engineering. The NOAA Sea Grant College Program has collaborated with the Corps to accomplish this public awareness in the lower 48. The University of Alaska stands ready to assist the Federal government and state of Alaska with the above research and education goals.

Discussion

Dr. R. Bruce Taylor asked Dr. Smith to give a feel for the difference in the tidal datums, the kind of magnitude, that they are seeing in Cook Inlet. *Dr. Smith* answered that they understand that mean lower low water is the zero on nautical charts, but it cannot be assumed to be at the same earth-relative place when the tidal range on which it is based varies within a quarter mile from place to place in this highly variable range. Therefore, the tidal ranges vary several feet from Fire Island to north of Anchorage on Knik Arm. *Dr. Taylor* asked about the transverse. *Dr. Smith* said they hoped to pin that down, but it appears from maps of the M2 constituent, which is the strongest of the tidal constituents, that it is about a foot. The same map shows several feet difference further down the inlet south of Anchorage, in the open inlet.

Dr. Taylor said that Dr. Smith mentioned coriolis. My experience with coriolis requires large-scale horizontal or spatial variance to become really significant. He asked if the wave is tilted as it comes up the inlet or is it something that is a transformation that occurs prior to the propagation into the interior waters. *Dr. Smith* was not sure how the behavior pans out in Knik Arm as this is a narrow, confined water body, but further down in Cook Inlet, the co-phase lines (basically like following the crest as it travels up the inlet are more or less perpendicular, following the inlet's alignment straight up) are dramatically slanted so that a point on the eastern shore has, again farther south, a tidal range several feet higher than a point on the western shore along the same co-phase line. He added that how that actually pans out in terms of coriolis and modeling, he could not answer, but was just pointing out these observations or measured effects.

Dr. Joan Oltman-Shay noted that in anticipation of the concern for the changes in sediment load with the potential warming or continued warming in this area and retreats of glaciers, it could be fairly traumatic here. There is much sediment to be moved. She asked if there is any activity underway right now to map the littoral cells of this region and their concomitant watershed sources. *Dr. Smith* answered that there have been some interesting meetings, and the idea has been discussed. The Kenai Peninsula Borough and the Kachemak Bay Research Reserve in Homer, AK, are very progressive the in way they are addressing this problem by educating their local governments and the public. In a meeting that

Ms. Molly McCammon sponsored, this was discussed, but he was not aware of a regional effort to accomplish that. *Dr. Oltman-Shay* reiterated that there were no statewide programs to really understand this big and pervasive issue of littoral cells, sediment transport, or sediment sources, which is really a regional sediment management issue. *Dr. Smith* was not aware of one.

Developing Wind/Wave Hindcast Climatologies for Alaska

Dr. David E. Atkinson
International Arctic Research Center
Department of Atmospheric Sciences
University of Alaska Fairbanks
Fairbanks, AK

Alaska has more coastal exposure than the rest of the United States combined. Eighty percent of Alaska residents live in designated coastal counties. Alaska also has a range of complex physical situations in the coastal environment, which includes the presence of ice in the terrestrial and marine regimes. These factors make development of both detailed wind and wave climatologies and accurate operational capacity for forecasting wave (and surge) conditions a priority for Alaskan waters.

High-magnitude wind event climatologies have been developed for the circum arctic region using hourly wind speed data from coastal weather stations (1950 – 2003). For Alaska, this was focused on the North Slope region. Results were aggregated along boundaries defined by the major coastal seas. A lack of general trend was noted; instead distinct activity regime shifts or decadal trends in wind event frequency were apparent. Hindcasts of seasonal wave energy totals (1979 – 2003) have also been generated using a simple Airy approximation with specified bathymetry and sea-ice presence defined by "ice-extent" passive microwave data. Results from this work underscore the importance of combining trends in wind and sea ice extent. National Center for Environmental Prediction/National Center for Atmospheric Research Reanalysis 10-m wind data have been compared with observed wind speed data from coastal, oil platform and ice-island data and found to systematically under represent high magnitude winds.

Efforts to improve Alaskan capacity are being initiated with support from the National Oceanic and Atmospheric Administration's *Integrated Environmental Applications and Information Program for the Pacifi*c, and will commence with a workshop to be held in August 2005. The goal of the FY05 workshop, part of the Pacific Region Integrated Data Enterprise (PRIDE) activity, is to deliver a coastal climatology plan that will support follow-on work in FY06, leading to a real-world demonstration project in FY07-08 as a contribution to the International Polar Year. The immediate plan will address ocean wave hindcasts combined with sea level changes, permafrost changes and related societal impacts. The objective of the demonstration project is to provide an improved applied operational capability to assess the risk of future coastal inundation, erosion, and their impacts. This effort is intended to complement similar activities in Hawaii and along the southeast coast (Carolinas, Gulf Coast). The short-term outcome of these projects will include risk management decision support capabilities, first along coastal

Alaska, and then a longer-term objective of broadening out to other Pacific and U.S. coastal areas. This initiative will be briefly reviewed during the talk.

Discussion

Dr. Billy L. Edge made a comment that on one of the images shown, there was a reference made to the fact that the storms were not increasing in contrast to what most people seem to think climate change is happening, but it appeared also that there were some curves in there where it did appear to be increasing. He asked Dr. Atkinson to explain why there are some locations that show more and some show none. *Dr. Atkinson* answered that the different areas show different trends, and what is actually of interest in that time-series plot are two things. One, there seems to be a longer-term periodicity in storm activities, especially in the Beaufort, so there was a period of high activity, and the last 15 years, it has been a decreasing trend. Two, at several sectors along the Russian side until the mid 1970s, there was a very flat, slight decreasing trend, but then there was a sudden jump in the level of activity, and now it is steadily decreasing.

Why is Subsistence so Important for Alaskan Communities?

Taylor Brelsford
Subsistence Coordinator
Bureau of Land Management
Anchorage, AK

Demography

- Alaska's cultural diversity is rich.
    - 5 Alaska native language groups.
- Rural Alaska is home to 125,000 residents.
    - 20 percent of the state population.
    - About equally Alaska native and non-natives.

Economics

- Rural Alaska is remote, with limited economic development and high costs for imported goods.
- The subsistence way of life is cash-dependent, but highly cash-efficient.
- Subsistence hunting and fishing is highly productive.
    - About 44 million pounds of food statewide.
    - About 375 pounds per capita.
    - Replacement costs of $130 - $220 million.

Ecology

- Species composition of subsistence harvest reflects diverse ecological adaptations.
    - Arctic coastal adaptation includes marine mammals as key component.
    - Interior riverine adaptation includes moose, caribou, salmon, freshwater fish.
- Traditional use areas reflect ecology and social-territoriality.
    - Traditional ecological knowledge is highly place-dependent.
    - Place names map of culturally significant places, embed ecological knowledge.

Society and Culture

- Subsistence creates bonds of communities.
    - Elders share knowledge and values.
    - Families and communities share in work to harvest and process foods.
- Core cultural beliefs center on subsistence.
    - World view holds that animals give themselves to humans who are spiritually ready.
    - Traditional stewardship based in respect for animals, shown through humility and avoiding waste.

- Key cultural value is generosity with food, shown in widespread sharing of subsistence goods.

Legal Frameworks

- Protecting subsistence a central focus of Alaska native political action since the 1960s, but unified treaty hunting and fishing rights were not adopted in Alaska. Instead, diverse Federal and state regimes have arisen.
- The Marine Mammal Protection Act (Federal) provides for unregulated, non-wasteful subsistence harvest by Alaska natives, and includes a commitment to co-management structures.
- Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA).
  - Applies on Federal lands only, about 60 percent of Alaska.
  - Defines subsistence as customary and traditional uses by rural Alaskans.
  - Establishes a priority for subsistence uses over sport and commercial takes.
  - Establishes Regional Advisory Councils to provide a meaningful voice.
- Alaska's Subsistence Law first passed in 1978, revised in 1986, and in 1990s.
  - Applies on state and private lands, about 40 percent of Alaska.
  - Provides a priority for subsistence harvests by "all Alaskans."
  - Implemented through broad public decision-making process, including local advisory committees.
  - Established a research program in the Subsistence Division of the Alaska Department of Fish and Game.

For a brief overview of subsistence practices, see:

Division of Subsistence, Alaska Department of Fish and Game, 2000, "Subsistence in Alaska: A Year 2000 Update." Available at:
http://www.subsistence.adfg.state.ak.us/geninfo/publctns/articles.cfm#SUBSISTENCE_2000

Detailed Community Studies including harvest surveys and maps of traditional use areas are found in the Division of Subsistence Technical Paper Series. Available at:
http://www.subsistence.adfg.state.ak.us/geninfo/publctns/techpap.cfm

Information concerning the Federal Subsistence Management Program is found at:
http://www.subsistence.adfg.state.ak.us/geninfo/publctns/techpap.cfm

Discussion

MG Don T. Riley asked for an assessment of what he saw as the partnership, the Federal agencies, state, and the native Americans. *Dr. Brelsford* said there is an emerging practice. He has observed over the last 20 years a whole series of experiments that often go under the term co-management. They talk

about structuring intensive consultation and cooperative relationships between state and Federal parties. In my view, this is the outburst of pragmatism. People found that this was necessary to be effective in wildlife or in land management. You could not ignore any of those key partners. Alaska and rural communities are very sophisticated about this, and some of the Federal agencies had to learn the ropes of these established practices of cooperative management or stakeholder consensus building.

Dr. Joan Oltman-Shay asked if there is any indication in elder tradition or stories of these people having experienced these types of climatic changes we are seeing today or in the past. *Dr. Brelsford* thought that we have passed the point of the sort of historic knowledge of responding to interannual variation and that we are dealing with unprecedented changes in trends.

Collaborative Approaches to Complex Problems

Dr. Henry P. Huntington
Huntington Consulting
Eagle River, AK

The Nature of the Problem

In January 2004, a pipe burst in the downstairs of my house. It was a nuisance. Fortunately, however, we had insurance, and the repairmen had the expertise and the tools to do what needed to be done. The insurance company paid the bills, minus a deductible, and there were never any questions about who was responsible for what or who would pay which costs.

Our experience is in sharp contrast to the situation of a coastal community facing a serious erosion threat. The nature of the problem may be pretty clear, but the solutions are far from clear. There are no well-known, tried-and-true, lasting fixes for an eroding coastline. There is no contract specifying who will be responsible for which costs and to what dollar limit. The social, cultural, financial, and physical implications of the various options available are only partly understood.

In short, our home flood required simply the application of existing expertise. The coastal village requires developing new understanding and expertise on all sides.

Why This Matters

The lesson for the case of coastal erosion is that collaboration is required to address the problem. No one has all the necessary expertise. There is no out-of-the box solution. In part, this is because no one has all the relevant information about the nature of the erosion itself, about the nature of the community, about the implications of various approaches, about the capabilities of and constraints on the agencies responding to the situation. The various individuals and groups must share information and expertise, working towards a more complete understanding of what is going on and what can feasibly be done.

What Is Collaboration?

What, then, does collaboration entail? In an April 2002 on-line workshop about changes in the nearshore environment, Canadian engineer Kenneth Johnson drew a distinction between two ways of framing the issue of coastal erosion in a village:

1. "The beach is eroding so you should move now."
2. "The beach is eroding and if nothing is done the water's edge will be where the middle of town is now."

He described the first as a "definitive engineering approach, which would have a dollar value attached," whereas the second was "a scientific approach … having a beginning but not necessarily an end." In the

course of the on-line discussion, others spoke of the need for the collaborative approach implied in the second statement above. Steve Solomon, another Canadian researcher, wrote:

> "the scientist has to be seen as a truly "honest broker" … and to be clear about uncertainty. The only way I see this happening is to become more engaged with the local population and to have them become an integral part of the study. This is not normally the way that I have worked in the past, but I have been moving in the direction over the past several years and I think it is certainly the way to move from advice to implementation of adaptation strategies."

This approach has several practical and philosophical aspects. A collaborative approach is likely to place the situation in a broader context than the physical reality of erosion. The local perspective may extend farther than direct impacts on, say, social structure or subsistence hunting. The history of native relations with government may be seen as relevant. Community members may be particularly sensitive to solutions that appear to be imposed from outside.

At the same time, collaboration requires that community members understand the constraints under which agencies operate. The budget for erosion remediation is not limitless, nor are there sufficient personnel to examine every aspect of the issue or attempt every possible prevention technique. How imminent threats are dealt with now may affect the resources available to other communities in later years, which is an issue for both the agencies and those other communities. Quickly, the situation becomes regional, statewide, and even national in scope.

In practical terms, collaboration also means relinquishing at least some degree of control. Relinquishing control does not mean abdicating authority or responsibility. Instead, it means recognizing that no one has sufficient knowledge or expertise to solve the problem, or even to evaluate every implication of each possible option. Collaborative decision-making requires real, live participation in the process, not simply having a report that addresses a particular question or perspective.

Some Examples

Let me now give two examples of how these ideas can work in practice. The first shows what can go right. The second shows some of the pitfalls.

The Alaska Beluga Whale Committee is a group of hunters, managers, and biologists committed to the conservation and continued subsistence hunting of belugas in Alaska. Over time, the group has built up a high level of collaboration, built on trust and a strong record of accomplishment, particularly in research. The hunters provide knowledge about belugas, information on harvest levels, samples for various analyses, and field expertise for other studies. The biologists and managers provide other knowledge about belugas, skill in designing and conducting various studies, and information back to the hunters.

My second example is a negative one, in that it shows how ambiguity about jurisdiction and authority can derail efforts to work together. The Alaska Migratory Bird Co-Management Committee has some degree of responsibility for determining which villages are permitted to hunt migratory birds in spring, and with what regulations for harvest levels and seasons. Despite the name, however, the committee functions more as an advisory body sending recommendations to Washington, DC, where the final decisions are made. The Service cannot abdicate its legal authority, but in practice it is appears that the different members of the migratory bird committee have different ideas about its role and authority. This ambiguity undermines the legitimacy of the committee.

I do not mean to suggest that collaborative approaches are clear cut, or that they are always effective, or that they work smoothly, or that they can be designed and implemented easily. Nonetheless, the benefits of successful collaboration often far outweigh the costs.

Features of Effective Collaboration

An essential component of collaboration is establishing a process that everyone understands, that is transparent, and that focuses on the principles of collaboration rather than specific outcomes. Some features of effective communication and collaboration are preparation, continuity, and experience.

What Is Needed

We need a better understanding of community needs and perspectives. I would go so far as to suggest that even community members may not have thought this through all the way. One way to think about it is, what makes Shishmaref Shishmaref? What are the key features of the place, its people, and its setting that are priorities for protection? Thinking about what makes their community what it is can help its residents articulate those characteristics and help in finding ways to minimize impacts in key areas.

We also need a better understanding of what is feasible from the standpoint of the various agencies involved. How effective are available means of erosion prevention or mitigation? What are the budgetary constraints, particularly if we examine the likely magnitude of the erosion challenge in the next decade or two? How much can communities expect from agencies, and how much should they expect to take on themselves? Which agencies are involved and with what responsibilities or areas of expertise and authority? Just as agency personnel need to understand the community point of view, community members need to understand the perspectives of the various agencies that are involved.

Such an approach may be needed at the village, the regional, and the statewide level. As I have noted, it is neither a smooth path nor a clear one. Nonetheless, addressing only part of a problem means achieving only a partial solution. Complex problems require broad, innovative approaches, which are best sought collaboratively.

Suggested Reading

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Huntington, H.P., P.K. Brown-Schwalenberg, M.E. Fernandez-Gimenez, K.J. Frost, D.W. Norton, and D.H. Rosenberg. 2002. Observations on the workshop as a means of improving communication between holders of traditional and scientific knowledge. *Environmental Management* 30(6): 778-792.

Discussion

MG Don T. Riley asked Dr. Huntington if, in his experience in working with some of these problems in Alaska, there is a need for a facilitator to be hired to collaborate between agencies. *Dr. Huntington* responded that sometimes it is necessary and helpful and other times not. In the case of the Beluga Committee, they knew each other and knew what they wanted to do. In other cases, you do need the middleman when you want conversation between the parties. It depends on the case.

Ms. Joan Pope asked how much of the location of the native Alaskan communities are defined by tradition and to the history of fiscal investments in that area, such as an airfield, a clinic, and houses. *Dr. Huntington* answered that over time, centuries and millennia, people have been fairly mobile. There are some settlements such as Point Hope that have been more or less the same location for three or four thousand years, but others have moved around depending on circumstances such as climate changes that have caused them to shift from or to an extensive whaling culture along the north coast. In the case of Shishmaref, the elders may adapt to change easier than the young people. The young people are used to the familiarity of a place, whereas the elders may have been seminomadic along that coast, so the fixation may be a little bit less, but, that may not compensate for telling them we have a nice spot where you can all move. He added that one of the important things to consider is how much that contributes to their sense of identity. The King Islanders still maintain a distinct identity, such as their dance troupe, despite being collocated with Nome. *Dr. Brelsford* added that prior to the 1950s, people traditionally lived in a series of seasonal migratory camps, and that pattern of seasonal migration was widespread across Alaska. After the 1950s, families were required to stay in what are now the current settlements in order for their children to have schooling. He added that most of our conversations with Alaska native communities concerning the prospect of moving far away will provoke great anxiety over the sense that people know the place names, the stories, the ecological history of an area where they have had very intensive relationships over many generations. The question now is how do we move to innovation, if it is necessary functionally, to consider new sites, new occupation, new pattern? How do we do that in a way

that does not rupture people's sense of confidence about their ability to live off the land? This is about who decides and is voluntary and collaborative and creates a spirit of adaptation.

Dr. Orson P. Smith noted that he had the impression that the population is growing in the bush. How is that going to impact subsistence resources in the coming decades? *Dr. Brelsford* responded that it is a question that vexes the environmental analyses of rural Alaska. There are a couple of trends and countertrends at work. The birthrate is high in rural Alaska. There is, however, the complicated pattern of migration. Smaller communities are losing population, as the young people and women move away. Communities in the 500 and above range are actually more robust in tending to retain more of their population. The out-migration from the smallest communities is aimed at Barrow, Bethel, Nome, and Kotzebue, rather than Anchorage and Fairbanks, but Anchorage and Fairbanks are hosting an enormous amount of rural out-migration at this point. The trend line is stable to slightly increasing for rural Alaska overall. Concerning the question of whether there is a one-to-one correspondence between population increase and pressure on resources, we have to take into account changing food preferences.
Dr. Brelsford added that he sees a viable future demographically in terms of reliance on sustainable harvest levels. There are some complex interactions between local resources and migration and demographic patterns.

The Denali Commission

Al Ewing
Executive Director
Denali Commission
Anchorage, AK

The Denali Commission

Senator Ted Stevens of Alaska authored the Denali Commission Act of 1998, which was signed into law on October 21, 1998, becoming Title III of Division C of Public Law 105-277, and was codified as 42 USC 3121. The Act is an innovative Federal-state partnership designed to provide critical utilities, infrastructure, and support for economic development in Alaska by delivering Federal services in the most cost-effective manner possible. With the creation of the Denali Commission, Congress acknowledged the need for increased interagency cooperation with a focus on America's most remote communities. The goal is to lower the cost of living and raise the standard of living throughout Alaska by ensuring all Alaskans have the means to achieve economic self-sufficiency.

The Act specified that the Denali Commission should have the following purposes:

- To deliver services of the Federal Government in the most cost-effective manner possible by reducing administrative and overhead costs.
- To provide job training and other economic development services in particularly distressed communities (many of which have a rate of unemployment that exceeds 50 percent).
- To promote rural development, provide power generation and transmission facilities, modern communication systems, water and sewer systems, and other infrastructure needs.

The Denali Commission Act was later amended on May 21, 1999, under Title I, §105 of Public Law 106-31. This amendment prohibited the Denali Commission from using more than 5 percent of its funding for administrative expenses.

The Denali Commission Act was further amended on November 29, 1999, by Title VII of Appendix D, §701 of Public Law 106-113. This amendment was a vote of confidence from Congress in that it expanded the Denali Commission's purview to include health care facilities. The Denali Commission was specifically directed to plan, construct, and equip demonstration health, nutrition, and child care projects, including hospitals, health care clinics, and mental health facilities.

The Denali Commission is administered by the Federal co-chair. The state co-chair is the Governor of Alaska. Five commissioners are appointed by the Secretary of Commerce from Alaskan statewide organizations that represent Alaskan natives, labor, the university, construction contractors and municipal

managers. The Commission's staff includes a number of professionals detailed to the Commission from various state and Federal agencies as well as personnel paid directly by the Commission.

Major Program Areas

Energy Facilities: The energy program funds design and construction of new bulk fuel tank farms, upgrades to community power generation or distribution systems, and a few energy cost-reduction projects. The Commission works with Alaska Energy Authority, Alaska Village Electric Cooperative, and other rural partners to meet rural communities' energy needs. Projects are selected on the basis of a statewide deficiency list developed in collaboration with Alaska Energy Authority and the regulatory agencies.

Health Facilities: In 2000, the Commission identified rural primary care facility needs in more than 288 Alaskan communities and estimated the cost of addressing these needs to be $253 million. Through its Health Facilities program, and in partnership with the U.S. DHHS, Alaska Native Tribal Health Consortium, the Alaska Department of Health and Social Services, the Rasmuson Foundation, Indian Health Services, and the Mental Health Trust Authority, the Commission is working to ensure all Alaskans receive access to safe and reliable health care.

Government Coordination: As reflected in its enabling legislation, the Denali Commission's first specific purpose is "to deliver the services of the Federal Government in the most cost-effective manner possible."

Working with other agencies, the Commission can eliminate duplication, share resources, and bring a 'best practices' approach to doing the public's business. Through its delivery of infrastructure programs, the Commission continues to lead by example in the area of government efficiency and coordination.

Training: The Denali Commission has placed job training at the center of its comprehensive plan for sustainable infrastructure and economic growth in rural Alaska.

Other Infrastructure:

- Multi-use facilities
- Washeterias (Laundromats with showers)
- Teacher housing
- Domestic violence shelters
- Solid waste facilities/management
- Transportation infrastructure

Key Commission Policies

Sustainability Policy: This policy is intended to ensure that provision is made for funding of operation and maintenance as well as renewal and replacement of all infrastructure funded by the Commission. A sustainable facility is one that meets a real community need; that makes use of

appropriate technology; and that works both today and into the future. The community must have enough money to keep the facility going so it can benefit from the facility's lasting value without becoming bankrupt.

Investment Policy: The purpose of the Investment Policy is to maximize the benefits to Alaskans of every public dollar invested in public infrastructure. The Commission's policy includes a number of factors intended to guide investments. One factor that is particularly relevant to this conference is environmental threats, which include flooding and erosion. On January 28, 2005, Governor Murkowski issued Administrative Order 224, which embodies the essential components of the Commission's Investment Policy.

GAO Report on Flooding and Erosion

According to the GOA report, "Approximately 6,600 miles of Alaska's coastline and many of the low-lying areas along the state's rivers are subject to severe flooding and erosion. Most of Alaska's native villages are located on the coast or on riverbanks." Congress directed GAO to study Alaska native villages affected by flooding and erosion and to 1) determine the extent to which these villages are affected, 2) identify Federal and state flooding and erosion programs, 3) determine the current status of efforts to respond to flooding and erosion in nine villages, and 4) identify alternatives that Congress may wish to consider when providing assistance for flooding and erosion.

GAO recommended that Congress direct Federal agencies and the Denali Commission to assess the feasibility of alternatives for responding to flooding and erosion. In addition, GAO recommended that the Denali Commission adopt a policy to guide future infrastructure investments in Alaska native villages affected by flooding and erosion.

Senate Bill 49 – Alaska Floodplain and Erosion Mitigation Commission Act

On January 24, 2005, Senator Stevens introduced S. 49, the Alaska Floodplain and Erosion Mitigation Act which would create a joint Federal and state commission to conduct studies regarding the feasibility of alternatives for flooding or erosion assistance, and to develop a policy to guide infrastructure investments in the Alaska communities affected by flooding and erosion.

Discussion

MG Don T. Riley noted that the efforts of the Commission is encouraging, especially when it comes to the integration of the Federal role in helping and assisting local communities, and we are trying to determine how the Corps of Engineers can assist in that and come in, with the state being in the lead.

Dr. R. Bruce Taylor noted how dispersed the population is, except for a few areas such as Anchorage, and the lack of transportation infrastructure. He asked Mr. Ewing to elaborate on the kinds of things that the Commission is looking at in that regard. *Mr. Ewing* responded that Dr. Taylor's

observations were consistent with everyone else. About the only way to get around rural Alaska is by airplane, snow machine, or water, and looking at the size of the state, air and water transportation are key. However, now the thinking at this point is that there is some efficiency that can be gained in the deployment of infrastructure connecting hubs. We have communities that are close together that could get by with one power plant, one school, or one clinic. A year ago, in our appropriations bill, we were asked to look closely at improvement of water transportation infrastructure. While communities are dependent upon water, in many cases they have poorly developed docks and just the basic things you need to be able to operate boats and water equipment, so that is another area that we might be helpful.

Dr. David E. Atkinson asked if there was a provision for maintenance for some of these facilities in place. *Mr. Ewing* responded that that comes into the business-planning portion of it. There is a provision made for sinking funds, so that you have adequate money when it comes times to replace, at least recover 40 percent of the costs, thinking that you will get a loan or other funding to replace 30 or 40 years down the road.

North Slope Science Initiative

Kenton P. Taylor
Executive Director
North Slope Science Initiative
Bureau of Land Management
Anchorage, AK

The North Slope Science Initiative (NSSI) is a collaborative effort among the resource agencies at the Federal, state, and local level to guide inventory, monitoring, and research in support of resource management on the North Slope. It is a recognized and jointly funded entity established in 2003 and governed by an Oversight Group consisting of the State Director of the Bureau of Land Management; the Regional Directors of the U.S. Fish and Wildlife Service, National Park Service, National Marine Fisheries Service, U.S. Geological Survey, and the Minerals Management Service; the Commissioners of the Alaska Department of Natural Resources and the Alaska Department of Fish and Game; the Arctic Slope Regional Corporation President; and the Mayor of the North Slope Borough. Advisory to the Oversight Group is the U.S. Arctic Research Commission and Department of Energy.

The goal of the NSSI is to enhance the quality and quantity of the scientific information available for aquatic, terrestrial, and marine environments on the North Slope and make this information available to decision-makers, agencies, industry, and the public. It will direct and facilitate a coordinated approach to information gathering and analysis on the North Slope and its associated marine environment; develop a collective understanding of information needs for regulatory and land management agencies, local governments, and the public; identify and prioritize information needs to address impacts of past, ongoing and anticipated development activities on the North Slope; and coordinate ongoing and future inventory, monitoring, and research activities to minimize duplication of effort, share financial resources and expertise, and assure the collection of quality information. It will also identify priority needs not addressed by existing agency science programs and develop a funding strategy to meet these needs, maintain and improve public and agency access to accumulated and ongoing research, and to contemporary and traditional local knowledge; and ensure through appropriate peer-review that the science conducted under the oversight of the NSSI and by participating NSSI agencies and organizations is of the highest technical quality.

There was no discussion following this presentation.

Newtok Traditional Council

Stanley Tom
Newtok Traditional Council
Newtok, AK

I work as a volunteer for Tribal Liaison for Newtok Traditional Council (NTC). The council has lack of funding for my position, but I don't mind because I want to assist my village move to solid land. It will be a permanent village.

During the 1970s, I attended a boarding high school at St. Mary's, AK, and graduated in 1980. Attending St. Mary's high school was one of my best experiences because there were students from many different villages, and the school taught us many responsibilities as well as academics. After the realization that college was not my interest, I began working for my community.

In 1997, I became the president of Newtok Traditional Council. I have helped the council contract with the Bureau of Indian Affairs P.L. 93-638 to improve our tribe and work directly with the Federal government. The first year of the contract was difficult because it was new to us, and we had no one who was qualified enough to maintain the 638 contract. Therefore, I found myself administrating the contract, which was a conflict of interest for a president to work as an employee.

After a year of administration, I demoted myself to an assistant administrator, which was part time, as it was too difficult to work full time as an administrator and operate my business, of which I owned and operated a small grocery store with seven employees. Working part time gave me time to create community development for the village move.

At that time, NTC designated The Association of Village Council Presidents Regional Housing Authority (AVCP Regional Housing Authority) to build housing units at the existing village. Apparently, no one in my community was qualified to apply for the grant proposal to begin the housing program, and I ended up as the volunteer for the AVCP Village Allocation proposal for NTC, and again became Tribal Housing Administrator, a position I still maintain.

For the past five years, I have worked as the Tribal Housing Administrator for NTC and the AVCP Regional Housing Authority, our tribally designated housing entities (TDHE) within our village. In the process, I submitted the NTC tribal work plan for the new village site, selected the site with the global position station, filled out a regulatory permit (33 CFR325), and had response from the Department of the Army (DA) for the four units, one from the AVCP Regional Housing Authority and three units from Bureau of Indian Affairs Housing Improvement Program (BIA HIP). There was no further permit required from DA.

As part of my responsibility, I requested jurisdictional determination for the barge landing activity location within the proposed area and had a response from the DA, and there was also no further permit required. The barge landing and the boat harbor is very important for development of the infrastructures that will include the barge landing, roads, township, landfill, lagoon, and the airport development.

The boat harbor is also important during the herring and halibut commercial fishermen season, which will protect the spring ice jam and fall north wind and high water protection. A letter was sent to Colonel Timothy J.Gallagher to seek assistance to build a barge landing and boat harbor for the new village site, but to this day NTC has not received a reply. I assume there is no funding available.

Since the 1980s, I have been actively involved in the relocation effort, and have been coordinating closely with the U.S. Army Corps of Engineers since 1999 as well as other agencies that will be participating in establishment of the infrastructure at the proposed new village site. My goal is to document and contact the state and Federal government agencies and officials to justify the efforts of the village relocation to Nelson Island and to support requests from agencies in the process of the village move.

In 1994, the Newtok Traditional Council started a relocation planning process as a response to the erosion problem. The council analyzed six potential village sites, and after an extensive research, the residents voted and selected one location. The selected relocation site is located on the north end of Nelson Island, approximately 9 miles southeast of Newtok, and is referred to as Takikchak. The native village of Newtok is entitled to convey pursuant to the Interior Department Land exchange Act of November 17, 2003, under Pub.L.108-129, 117 Stat.1358, of surface and subsurface estates in the described lands designated as Proposed Villages entitled proposed Newtok Exchange, dated September 2002. The Interim Conveyance was issued by the United States, Department of the Interior, Bureau of Land Management grantee.

The Newtok Traditional Council has initiated a village relocation planning process in order to prepare for the imminent encroachment of river bank erosion on its residences and facilities. The Council hired ASCG Inc. to develop a Land Use and Transportation Plan for their proposed village relocation site using funding from the Bureau of Indian Affairs Indian Reservation Roads program. This plan provides an update of existing community characteristics, summarizes the erosion problem and past mitigation efforts, presents a preliminary site plan map for the proposed relocation site, and identifies and describes road needs and priorities. The plan will provide a foundation for future community development studies as knowledge of conditions and opportunities at the relocation site increases.

To prepare the transportation plan, ASCG collected and assembled data from Federal, state, regional, and local sources. ASCG worked closely with Council staff and members in developing the

plan and associated mapping. The site plan and road priorities were approved at a public meeting held in Newtok on February 27, 2001.

There are approximately 6.71 miles of proposed road to be constructed at the new village site. The road project is shown on the Proposed Relocation Site Plan map that needs more adjustment of the because of the environmental concerns, such as the lagoon, land fill, the power company, and the new tank farm. I again volunteered for Indian General Assistance Program (IGAP) grant proposal for 3 years and finally received grant proposal for FY05.

The Denali Commission provided funding to the Alaska Energy Authority grant for Newtok Traditional Council to upgrade their electric power, and the Alaska Energy Authority needs to start a preliminary feasibility study overview of the selected site and the environmental assessment or NEPA letter grant agreement and serve electricity for the four units. The ACVP village allocation funding will be established every year, phase by phase, because the funding is limited.

Conclusion

I want to thank all the agencies for allowing me to take this opportunity to make a full report of the relocation effort. I know how difficult it is to ask for your assistance during the conflict in the Middle East. The community of Newtok strongly believes that we need to work together for the safety of our people and for the sake of the younger generation, where we will never fight over our land again with anyone. Our land is a lifetime permanent ownership passed on from countless generations, and in this age, we would rather not discuss the land issue. We have proven the Federal and the state government that we discussed the relocation effort for more then 25 years.

The relocation effort is very important to us, and we don't have very much time left because the speed of the beach erosion problem. We do not want to move to Bethel or to any of the surrounding villages because the area we inhabit is our traditional home, where subsistence way of life is accessible. The community of Newtok sincerely hopes that we will continue to communicate and provide us with enough resources that will make the relocation possible within the next 5 years.

Discussion

Dr. Billy L. Edge asked for a clarification as to the location of the new village site. *Mr. Tom* indicated that it was right across, about 9 miles, from Newtok.

Mr. Charles B. Chesnutt asked the Alaska District for the status of the project, if this was a Corps project yet, a feasibility study, or a request. *Mr. Larry J. Scudder*, study coordinator on the Newtok project, answered that they are investigating the relocation aspects. They are using tribal partnership funding. However, due to constraints placed on them, that work has come to a halt.

Coastal Engineering: Tribal Partnership, Shishmaref, Alaska

Alan C. Jeffries
U.S. Army Engineer District, Alaska
Anchorage, AK

Introduction

This presentation describes the technical aspects of the coastal engineering tasks associated with the Tribal Partnership Program, Shishmaref, AK. It provides the background for determining the extent of the erosion problem, the future timeline for loss of land due to erosion, and potential structural measures that could provide coastal erosion protection for the community.

Climatology

Shishmaref is located on Sarichef Island, approximately 130 air-miles northwest of the city of Nome and 100 air-miles southwest of Kotzebue. The community is located on the Chukchi Sea at latitude 66°15' N and longitude 166° 4' W. The area experiences a transitional climate between the arctic and continental interior. Normal winter temperature ranges from -20 °F to 10 °F, while summer temperatures range from 47 °F to 54 °F.

Winds

Historical wind speed and direction data are not available for Shishmaref. Wind data are available for both Nome and Kotzebue. Specific design wind speed and direction has not been determined, rather a range was estimated based on observations during storms over a period of 30 years. Indications are that winds of 40 to 50 mph with a maximum of 65 mph occur during damage causing fall storms. Predominant wind directions are southwesterly and northwesterly.

Tides

Table A-1. —Tide elevations, Shishmaref, AK

Level	Elevation (ft. MLLW))
Mean Higher High Water (MHHW)	+1.0
Mean High Water (MHW)	+0.9
Mean Tide (MSL)	+0.5
Mean Low Water (MLW)	+0.1
Mean Lower Low Water (MLLW)	0.0
Extreme Low Tide	-0.8

Source: NOAA National Ocean Service.

Storm Surge

Storm surge at Shishmaref has not been studied in-depth, however, indications are that the area does experience significant storm surges. Highest storm surge elevations are likely to be on the order of approximately +8 ft MLLW during extreme low-pressure events.

Sedimentation – Littoral Transport

Primary direction of sediment movement is from the west to east. Depending on the direction of storm waves, however, sediment transport can also be from east to west. Sediment sources include eroding beach bluffs and from onshore-offshore movement. There are about 2 miles of eroding shoreline that combine with offshore sediments and sediments from adjacent islands to provide a source of littoral material.

Ice Conditions

Sea ice (pack ice) is present in the Chukchi Sea during the winter months. Freeze-up typically occurs in early November and breakup occurs in June. The waters in the vicinity of Sarichef Island are generally ice-free year from late June thru October. In recent years, this ice-free period has been increasing. The arctic ice pack has decreased in size by 5 to 10 percent in the last 30 years.

Wave Climate

Open ocean swell (long period waves) can reach the area from the southwesterly direction; however, such waves travel from long distance through the Bering Straits and strike the shoreline at an oblique angle. Long period swell that does reach the shoreline along the community has reportedly not been the primary cause of erosion. Rather, shorter period waves from locally generated storm conditions appear to be the most problematic. The shoreline is directly exposed to the southwesterly and northwesterly fetches across the Chukchi Sea. Waves heights are generally in the 5 to 8-f high range with periods of 4 to 5 sec based on local observations at the shoreline. Events with waves as high as 15 ft have been reported during extreme storm conditions.

Erosion Rates (Aerial Photography, Community's Measurements)

Erosion rates were analyzed using aerial photography dated July 12, 1972; July 18, 1980; June 17, 1984; and July 19, 2003. These four flights represent the extent of available aerial photographic data. Each flight was used to estimate the alignment of the top of bluff line along the beach frontage. By overlaying the top of bluff extent for each year of aerial photography, a history of bluff recession was prepared for the last 31 years. Results of this analysis indicate an average annual erosion rate from a low of 2.7 ft per year to a high of 8.9 ft per year depending on the station location along the bluff.

Erosion rates were also analyzed using distance measurements performed by the residents of Shishmaref taken at various intervals from the fall of 2001 to fall of 2003. Measurements were taken a total of 10 times over this period. Most of the measurements were taken after significant storm events

caused loss of land due to erosion. These measurements were used to lay out the estimated top of bluff lines for four selected dates: fall 2001; July 1, 2002; November 11, 2003; and November 25, 2003. By overlaying the top of bluff lines for each date, bluff recession was estimated for the last 3 years. Annual erosion rates were again estimated by using measured distances from fixed points in the community such as existing buildings to the top of bluff. Results of this analysis indicate an average annual erosion rate from a low of 13.0 ft per year to a high of 22.6 ft per year depending on the station location along the bluff.

Recommendations for Future Study

- **Wave Analysis** - Wave hindcast (Hs, T), instrumentation for wave characteristics measurements, numerical modeling (STWAVE).
- **Water Level Analysis -** ADCIRC.
- **Hydrographic/Topographic Survey -**Topographic survey, beach profiles at selected cross-sections, offshore bathymetry.
- **Ice Extent/Cover** - Further research into the freeze-up/breakup occurrence trends, sea ice cover, ice thickness, and ice-pack extent.
- **Currents -** Instrumentation for current measurements.
- **Soils/beach sand composition -**Geotechnical investigation: beach and bluff grain size distribution, composition, and depth to permafrost, organic layers, potential borrow sources for beach nourishment.
- **Detailed Alternative Analysis -** Detailed engineering analysis of possible structural alternatives: beach nourishment, gabions, offshore breakwaters, groin fields, and revetments.

Discussion

Ms. Patricia S. Opheen of the Alaska District led discussion questions. *Ms. Opheen* noted that it seemed evident that there is a lack of documented available data to do engineering studies. She asked as to the availability they have been able to extract from the residents other sources of information, and what is done when there is no information available. *Mr. Jeffries* said that for the rural parts of the states, they do rely on local observations during storm events for information, and most of the time, they are good, detailed observations.

Ms. Opheen asked if Mr. Jeffries had any idea as to why the erosion rate would be increasing. *Mr. Jeffries* stated that the conventional wisdom is that the decrease in ice protection is extending the open-water season further into the fall, which is more prone to these large low-pressure storm systems and the frequency of storms seems to be increasing in the last 5 or 10 years, thus, erosion rates are correspondingly increasing.

Ms. Opheen asked where they find the balance on the additional data needed to do the engineering studies and actually begin design and what do they do when that data are not available when it is time to design. *Mr. Jeffries* stated that they are getting more successful in actually instrumenting some of the remote sites, but cost is always a factor. If that is not practical, the local communities can help with a more detailed observation program such as videotaping or measuring high-water marks. The community of Shishmaref has been taking good measurements. They have done baseline measurements during the summer, and after every storm, they go out and take those same measurements at particular stations.

Ms. Opheen asked if the erosion issues on the island were typical or atypical. *Mr. Jeffries* stated that they seem to be typical for that part of the state. All along the coastline that includes Newtok, Kivalina, Barrow, and Point Hope, there is increased open-water season and higher frequency of storms. The other is just the bluff composition along that stretch of the state. It is a very fine sand material, and under a thawed condition with any wave action, there is nothing to hold it. *Ms. Opheen* asked if Mr. Jeffries was aware if this coastline is similar to any coastline in the contiguous United States. *Mr. Jeffries* was not aware of any; however, *Ms. Joan Pope* responded that it is hard to understand the physical conditions that you are dealing with at a site without having seen it, but this site may be similar to sites in western Lake Erie. She suggested that there may be other alternatives that may help.

Ms. Opheen asked why construction at Shishmaref is so expensive. *Mr. Jeffries* responded that the main factors are its remoteness of getting equipment and materials to the site and the shortness of the season, which is typically only 3 or 4 months, so a project that might take 6 months, takes 2 or 3 years to complete.

Ms. Opheen asked where the closest gravel source was and can it be barged to the island. *Mr. Jeffries* stated that the rock for the rock revetment project came from Nome and is 150 miles away by barge. That is fairly close compared to some projects that would have gravel barged in from 500 to 1,000 miles away. For sand, if a beach nourishment project were proposed, possibly the shoals at the ends of the islands or possibly offshore, could be borrow sources.

Ms. Opheen asked if commercial barging is available from Nome. *Mr. Jeffries* said that there are no barges based in Nome, but they are there every summer. However, it is difficult to secure barges because they are being used all summer on numerous projects.

Dr. Joan Oltman-Shay asked about the aerial work. She asked when they were calculating their erosion rates, did they get a sense that the island itself was reorienting itself, possibly growing to the east, filling in in the back lagoon. Is there any sense of total area loss to the island? *Mr. Jeffries* answered that the aerial information did not cover that because the aerials did not extend to the ends of the island, so he

did not know whether the island was growing in length as it is receding. The aerials were confined to the frontage right along the community.

Alaska District Coastal Engineering Policy and Planning Issues

Bruce R Sexauer, PE
Senior Plan Formulator
U.S. Army Engineer District, Alaska
Anchorage, AK

Overview

Developing Corps of Engineers projects in the state of Alaska provides several challenges. Some of these are common to districts throughout the Corps but several are unique to Alaska. This presentation will describe these various issues and identify some ongoing and potential solutions.

Alaska's coasts and riverbanks serve as the home to over 200 Alaskan communities that utilize the rivers, coastal waters, and surrounding areas for subsistence. Coastal areas are subject to constant attack from wave action, ocean currents, ice, and storms; and riverbanks are subjected to flooding, annual and episodic ice jams, and erosion.

The flooding and erosion that occurs along Alaska's shorelines and riverbanks can have a devastating impact on the economic, social, and cultural well-being of the Alaskan communities that are located along them. Recently, the Alaska District has noted an increasing number of requests for flooding and erosion protection assistance. This increase appears to be timed similar to observed climatological changes that may have an impact on flooding frequencies and erosion rates.

As of 2004, the Alaska District has received 63 requests for assistance with flooding and erosion problems from 60 communities in Alaska. Recently, the number of requests for assistance due to flooding, storm damage, and erosion problems have increased. Of the 63 total requests, 47 have come within the last 5 years. The District constructed eight flood-control (seven Specifically Authorized and one Section 205) and eight erosion-control projects (four Congressionally Authorized and four Section 14) in Alaska at 14 communities.

Many of these requests have failed to produce feasible solutions. The three main factors that have led to the lack of success are 1) communities' inability to cost share, 2) the lack of allowable National Economic Development (NED) benefits, and 3) the high cost of construction in Alaska.

Inability to Cost Share

Of the authorities that the Corps of Engineers has to address flooding and erosion problems in Alaskan native communities, all require cost sharing by the local sponsor. While some communities are financially capable, many of the small communities do not have the ability to cost share even the small Section 14 projects that require a local cost share of 35 percent. Their economies are not wholly cash-based, so local governments have a limited tax base. Many of these communities have a high percentage of the population living "below the poverty level." These communities have a subsistence economy that

is often more robust than the cash economy measured and evaluated by the National Census. There are many healthy and socially fulfilled people in these communities living "below the poverty level."

Other sources of funds for the required local cost share have been difficult to obtain. Communities have applied for Community Block Development Grant (CBDG) funds toward construction of erosion control projects, but they were unsuccessful. In recent years, the District's only cost-shared erosion control projects are in Barrow, Bethel, and Homer, all large hub communities that have financial resources, and Shishmaref, where the school district has obtained funds from the state to preserve the school infrastructure. Our other erosion control projects, Dillingham and Galena, were specifically authorized by Congress at 100 percent Federal expense.

Non-NED Benefits

For similar reasons to why a community cannot cost share, oftentimes a community will not have significant amounts of high cost infrastructure, thus, limiting the amount of typical NED benefits. More times than not, it is the way of life of the communities that is threatened first. As the shoreline erodes, fishing grounds, processing areas, storage facilities, and boat landings are the first items to be destroyed. With a lessened ability to harvest their subsistence resources, the locals depend more and more upon shipped in food and supplies. By the time the infrastructure is threatened, a community will have already sustained substantial impact to traditional and subsistence resources. Much of the land used for these activities are under private ownership, thus not allowing for Federal participation for protection. Even if all the NED, regional benefits, and other social effects were captured, because of the high cost environment, projects still have less than required benefit/cost ratios.

High Cost of Construction

The cost of building flood and erosion prevention structures is much higher in remote Alaska than at similar situations in the contiguous United States. Commercial sources of construction material, equipment, trained labor, supplies, support facilities, and fuel are limited in the remote regions of Alaska. Modes of transportation are usually limited to shallow draft barge or air transport. These are costly. The construction season is effectively limited to 5 or 6 months due to the extreme weather conditions.

Construction equipment is typically not available in remote areas and has to be barged into the site. Most transportation of equipment occurs by barge during limited shipping seasons. If the equipment does not make the last barge before freeze-up, it will sit idle all winter. It is often 6 months or more until the next barge can make it to the site. Mobilization costs approach a half a million dollars on small-scale bank stabilization projects. Barge access may not be available, in which case the equipment must be walked cross-country in winter. This is a costly high-risk operation for a contractor.

Fuel often needs to be shipped in as well. Many communities in remote areas barge in only as much fuel as can be stored and that they can afford to buy in the fall before the rivers and inlets freeze.

Fuel supplies may be limited in the spring. To get an early start on the limited construction season, contractors may arrive in an area in early spring and find limited fuel and the next fuel barge is not scheduled until June when the river is navigable. These contractors often resort to flying their fuel in on small planes, 150 to 200 gallons at a time. Larger deliveries are not possible given the size of the airports associated with these communities. Gasoline in Shishmaref currently costs over $5.00 a gallon.

New Authorities

Congress has recognized the unique nature of Alaska and has provided many specific authorizations, Alaska only legislation, and significant appropriation Act and Report language to overcome the above mentioned issues. Some of these include:

- Tribal Partnership Program – Section 203, WRDA 2000. This program authorizes feasibility studies of water resource projects that will "substantially benefit Indian tribes and that are located primarily within Indian country or in proximity to Alaska native villages." The program provides no construction authority. Non-Federal cost sharing requirement is 50 percent for feasibility studies.
- Fiscal Year 2005 Consolidated Appropriations, P.L. 108-447, Division C Section 117. Notwithstanding any other provision of law, the Secretary of the Army is authorized to carry out, at full Federal expense, structural and non-structural projects for storm damage prevention and reduction, coastal erosion, and ice and glacial damage in Alaska, including relocation of affected communities and construction of replacement facilities."
- Base Erosion Assessment - Fiscal Year 2005 Consolidated Appropriations, P.L. 108-447, Division C included the following language– "The conference finds there is a need for an Alaska erosion baseline study to coordinate and plan the appropriate responses and assistance for Alaska villages in the most need and to provide an overall assessment on the priority of which villages should receive assistance. Therefore, the conference has provided the $2,000,000 for this study."

Budget and Policy

The last of the issues relate to budget and shifting Corps policies. For the most part, the work that is being done to assist the communities with their various issues are not consistent with Corps budget policy, therefore, are never within the Corps budget. Congressional adds are becoming the norm for almost all of the Civil Works workload in the Alaska District. Many times these adds come with specific guidance in the form of act or report language. This language is most often at odds with Corps policy. What happens is that the District now has many projects and studies that are not "budgetable" and are not "consistent with policy". These adds receive significant scrutiny and review oftentimes delaying the initiation of the study or project effort until typically 9 to 12 months after the funds were appropriated.

Often, additional language is needed to provide clarification for Corps Headquarters or Assistant Secretary of the Army (Civil Works) to release funds to be spent.

There are also several changes to the way the Corps will be analyzing projects for feasibility. Several new policies are changing the formulation process, the economic models being utilized, the review procedures, and the timelines for study completion. The "Big Picture" issue is that there are significant changes that are occurring, and several issues that still need to be addressed.

Discussion

Ms. Patricia S. Opheen led the discussion. *Ms. Opheen* asked that with the Corps' planning methods available to utilize, the baseline erosion assessment of $2 million, and the Section 117 legislation, what do you have available to get to "yes." *Mr. Sexauer* answered that they have new authorities. Section 117 does not have any funding associated with it yet. It is a precedent-setting piece of legislation. As it starts to get used, more and more communities will also want to use that for 100 percent of the Federal expense as well. We need to be judicious in how we are going to use that, and to guide and apply that legislation and new policies to help these communities, we have good assistance from the District, and we have to work with our regional teams and with Headquarters. We realize that budgets are limited and decisions have to be made at some point in time.

Ms. Opheen asked Mr. Sexauer to choose one of the new policy changes that he advocates and what he views is his biggest hurdle. *Mr. Sexauer* stated that he believed the biggest hurdle, as an organization, was the ability to be able to implement the Congressional adds that are in questionable policy zones. As far as the new policies, he liked the regulation on collaborative planning establishing the water resources review board to provide the final check and balance that we need when we implement some of these projects. *Ms. Opheen* added that this is a complicated process for us who work in it, so how do we translate that to the local community? *Mr. Sexauer* said that he views his job as to be both the Corps' and the community's advocate through the process. He would never expect the community to fully grasp and understand all the intricacies of the Corps' policies. It is his job to translate that in the best way he can, and to do that is to spend time with the community and understand more about how they communicate, their culture, and what their concerns are. It is significantly different in Alaska than from most areas in the United States, and it takes an enormous effort to do this. It you are going to Shishmaref for even a 2-hour meeting, it is a 3-day investment in time. If you go there for a few days, it is an investment of time, energy, and resources. Some dedicated staff members are willing to spend weeks at a time in Shishmaref to help understand their concerns.

Ms. Opheen asked if there was anything in particular about the erosion Shishmaref is experiencing that is notably different. *Mr. Sexauer* answered that it is pretty similar all along the coast

through there. The erosion in Shishmaref concerns him, but what concerns him more is the report that GAO put out saying that 189 out of 204 villages experience some sort of flooding or erosion problems. There are enormous issues in Alaska, and we need to start doing some serious work to start providing assistance.

Dr. Billy L. Edge asked if we are wasting time trying to do expensive engineering on a permanent solution instead of looking at something to be much more temporal. *Mr. Sexauer* said that they actually do not have the authority or the funding to be looking at a permanent solution and are trying to provide them some ideas of things they can do until they can relocate. As far as spending time on expensive studies, the work that was done was to demonstrate why it is important for Shishmaref to remain together as a community and to stay in that area rather than be relocated or collocated over to Nome or Kotzebue.

Dr. Joan Oltman-Shay asked Mr. Sexauer if they had the authority to help identify other locations that might be more geomorphologically stable for the community to move. *Mr. Sexauer* said there was some good work done by NRCS to help the village identify a location. They began looking at 13 different sites around the Shishmaref Lagoon, identifying places that are outside the erosion hazard area, one that has suitable flat land and has good water supply, an area called Tin Creek. Since NRCS did work, we did not see a need to reinvent the wheel.

Shishmaref Erosion and Relocation Coalition

Luci Eningowuk
Chairperson
Shishmaref Erosion and Relocation Coalition
Shishmaref, AK

Relocation and Erosion Concerns in Shishmaref, AK

- Relocation of the existing community to the mainland.
- Ongoing beach erosion and efforts to minimize its impact.
- Lack of funding for immediate infrastructure needs.
- The need for state and Federal multi-agency coordination.
- Life in Shishmaref.
- Subsistence.

Discusssion

Ms. Patricia S. Opheen led the discussion with Ms. Eningowuk. *Ms. Opheen* asked if there was any staff to interface with the three government entities, the village, the city, and the native corporation. *Ms. Eningowuk* said that Mr. Tony Warwana, Sr., is employed by the Corps to assist with the Shishmaref erosion and relocation efforts, and to assure that they also get help from the media. *Ms. Opheen* asked if the media meets in Anchorage, Fairbanks, or Shishmaref and what draws the media to Shishmaref. *Ms. Eningowuk* stated that the media gets to Shishmaref and the draw is the people. They are very artistic. They are known for their fine sewing, arts and crafts, and they have dog teams. She added that the Coalition is aware of the erosion that is occurring at the airport and the loss of the airfield would be significant because that is their way out. She also added that they are all aware they need to relocate. They have been working on it, but have not gotten anywhere. They need help to coordinate and need assistance from the Federal Government or the state of Alaska. The erosion rate has really accelerated in the past couple of years. The relocation site of Tin Creek is about 13.5 miles inland and they could still have access to the ocean.

Ms. Joan Oltman-Shay asked if they preferred to move structures in the wintertime versus the summertime. *Ms. Eningowuk* said that it is easier to move structures in the wintertime. All new buildings are placed on Triodetic foundations so they can be moved.

The discussion was then addressed to all three speakers, Messrs. Alan Jeffries and Bruce Sexauer, and Ms. Eningowuk. *Ms. Opheen* asked Mr. Sexauer about the status of the Section 14 permit and its criteria. *Mr. Sexauer* answered that they had gone out to bid for that construction and that the

construction costs were beyond the amount that the Section 14 program allowed. The state provided partial money to construct bank protection projects and recently provided the balance needed to make up for the excess costs, so construction of that Section 14 structure can begin this summer. He stated that the intent of the Section 14 program is to provide emergency bank protection, and projects are typically designed to have long life spans, but because of the instability of the soils there, this project is estimated to have a 5- to 10-year project life.

Ms. Opheen asked Mr. Jeffries how they design a project such as this with limited data. *Mr. Jeffries* answered that they adopted the same design life as the further west revetment that was constructed and designed by an AE because it does not make sense to build a 50-year structure when and if the further downstream project fails, that project would fail just by flanking.

Ms. Opheen asked Ms. Eningowuk if the coalition was actively involved in defining the project. *Ms. Eningowuk* answered in the affirmative.

Dr. Oltman-Shay asked Ms. Eningowuk if there was a plan in place for a rapid emergency relocation. *Ms. Eningowuk* said they had been working on that, but it had not become a reality yet. *Mr. Sexauer* added that as part of our assistance, we worked up a design analysis and have plans for what a structure might look like, but do not have the construction authority to implement it. *Dr. Oltman-Shay* asked if anyone has gotten the word out to FEMA. *Mr. Sexauer* answered that FEMA is aware of the issue. After the 2004 storm, FEMA did provide some assistance, but unfortunately, FEMA can only step in when an actual structure has been damaged. For example, FEMA was not able to consider the teachers' housing as a damaged structure because it was still standing. The only thing they could do was some bank protection, but since the Corps of Engineers had a project already in place, they were unable to do the bank protection.

Mr. Stanley J. Boc asked if the property in Shishmaref is communal or privately owned. He also asked if the airport built by the FAA, and if it was, have they been approached to protect it. *Mr. Sexauer* said that much of the property is privately owned. To answer the second question, *Mr. Sexauer* said that the airport was built by the FAA, and they are looking at what imminent danger there is to the runway, especially the eastern end of the runway, which is starting to become endangered. *Mr. Charles B. Chesnutt* asked if there is coordination between the Corps and the FAA. *Mr. Sexauer* stated that there was not any formal coordination with the FAA, but they are continually trying to work the coordination issue. The work the FAA is doing is on the opposite end of the runway, so they are not adjoining issues. He added that if there is such a time when the Corps is authorized with a short-term fix that would address erosion along the entire island, the Corps would work with the FAA closely on how we protect the runway. *Mr. Chesnutt* asked what was the next step on the Section 14. *Mr. Sexauer* answered, "Construction." He added that the Corps will soon start working with the contractor on some of the

premobilization activities. *Mr. Boc* asked why there was no construction in the winter because there is no water moving around then. You can dig through it. *Mr. Sexauer* answered that it is 30 degrees below zero at times, and the sea ice is dangerous as it piles up on you. It is a life safety issue. Also, all supplies have to be barged in, and you can only barge during the summer months. It is also too expensive to have a crew on standby and to have and also maintain equipment on the island to take advantage of opportunities of mild weather in the winter.

Dr. Billy L. Edge asked Mr. Sexauer to give the physical scope of the Section 14 band-aid and does it connect with the existing revetment that is there. *Mr. Sexauer* said that the Section 14 is about a 200-ft piece of bank protection, which will mostly protect the teacher housing and the school. He added that there is approximately a 3,000-ft piece of waterfront that has buildings, which are in direct harm's way. When you include the runway, you have about 8,000 ft, but this is not part of a Section 14. If we were to put in a temporary protection for Shishmaref, the estimate would be approximately $15 million. *Dr. Edge* asked if it connects with the existing revetment that is there. *Mr. Sexauer* stated that it would tie into that. *Dr. Edge* asked if it provides that cutoff that has been missed already. *Mr. Sexauer* said it will provide some of it, although the one end, which is being outflanked, would still be unprotected. That is getting back to the Section 117 authority that was put into the Energy and Water Bill last year, and that authority is exactly the type of thing that we would need to utilize to construct this temporary project.

Port of Anchorage

Governor William E. Sheffield
Port of Anchorage
Anchorage, AK

The Port of Anchorage (POA) occupies approximately 129 acres and contains three major functional areas: the dock structure and berthing areas; storage areas; and the transportation network (roads, rails, and pipelines). The berthing area provides three container ship terminals (Terminals 1, 2, 3) and two Petroleum, Oils and Lubricants terminals (POL 1, POL 2); surface facilities for the POA offices and maintenance shop; three 38-gauge cranes; and other facilities for loading and unloading dry-bulk and liquid-bulk cargo.

The POA's mission is to provide a modern, safe, and efficient facility capable of effectively handling the quantity (4.4 million tons in 2003) and variety of cargo entering and leaving the POA, and to stimulate economic development while meeting future growth demands. As an economic leader, it generates more than $750 million annually for the state's economy. The POA is self-supporting, receives no tax support from the Municipality of Anchorage, and funds facility improvements through its revenues and grants. It is the largest of the state's 95 public ports and harbors.

The POA stages 100 percent of exports of refined petroleum products from the state's largest refinery and facilitates petroleum deliveries from smaller refiners on the Kenai Peninsula and in Valdez. Approximately 60 percent of inbound freight is destined for the Anchorage Bowl, with the remainder destined for delivery throughout the state. The POA handles:

- All of the jet fuel for Ted Stevens Anchorage International Airport, JP-8 fuel for Elmendorf AFB, and petroleum products for Alaska's bush area;
- Goods for all major military installations; and
- Wholesale goods for all retail distributors and grocery stores north of Cordova.

The POA is operating at or near critical capacity ranges for various types of cargo. For example, liquid-bulk, primarily in the form of POL, is the largest category of POA cargo, accounting for approximately 2.6 million tons of the 4.4 million tons received by the POA in 2003. The capacity for POL products at the POA is estimated to be about 2.8 million tons. Thus, handling of liquid-bulk products reached 93 percent of the SPC in 2003. Similarly, inbound vans, flats, and containers representing major cargo handled by the POA, and accounting for 1.7 million tons of the 4.4 million total tons handled by the POA in 2003, exceeded the sustainable capacity estimated for the POA.

POA usage is currently limited by its facilities resulting in congestion at all of its five terminals. Conventional bulk carriers with a laden draft of over 40 ft are required to schedule arrivals and departures in order to avoid being delayed by low tide. In addition, terminal POL 1 is not considered to be

sufficiently stable to support the pneumatic off-loader needed for moving dry-bulk cargo, and neither terminals POL 1 nor POL 2 have the capability of supporting the heavy lift equipment required for containerized cargo. Cruise ships are sometimes required to use Terminal 3 during times of congestion, such as when a cement vessel is stationed at POL 2. However, new security requirements cause issues with the transportation of passengers within the secured POA area. A cement vessel can require over three weeks to unload, resulting in further shipping traffic congestion.

POA facilities, including the terminals and docking berths, are substantially past their design life. Corrosion and other impacts have reduced the structural integrity of many of the areas to critical levels, and inspecting engineers have determined that the facilities are at substantial risk, especially during a significant seismic event.

The POA presently is undergoing a major expansion to replace functionally obsolete facilities and expand capacities to meet the growth needs of Anchorage and Alaska. The POA provides critical goods to Anchorage and the state of Alaska. However, it lacks critical features to meet current and predicted additional needs and to maintain its level of service over the next 20 years given forecasted growth in demand for POA services. These needs include:

- ***Necessary replacement of obsolete infrastructure.*** Certain elements of the POA's existing infrastructure are functionally obsolete and near or below design safety standards for seismic events.
- ***Ability to withstand harsh environmental conditions.*** The Upper Cook Inlet provides challenges in the form of strong currents, the second most widely fluctuating tides in the world, ice buildup, scour from ice and silt, and earthquakes that any POA expansion proposal must consider.
- ***Additional capacity to accommodate growth in current customers.*** Current and near-future cargo-handling capacity will continue to exceed maintainable, safe, and efficient levels.
- ***Additional berths to provide service to new customers.*** Expected growth of operations coupled with existing customer demand will result in at least 40 percent growth in ship calls, causing berthing conflicts, increased waiting times for berths, and increased transportation costs to the public.
- ***Deeper drafts, longer berths, larger cranes for offloading, and more streamlined intermodal transportation to efficiently handle new ships and to move the increasing amount of cargo out to the public.*** Current trends in maritime transportation have produced larger, longer ships that cannot currently be supported by the POA. With deeper drafts and wider beams, these large ships require longer berths and cranes with a wider capacity for unloading. Failure to expand would result in increasing inefficiencies and costs for shipping

goods to Alaska's customers. Loading procedures at ports of origin are currently restricted by the POA crane reach.

- ***Lighting, gates, and other features to meet new security requirements under the new Maritime Security mandates.*** The POA, like all U.S. ports, must construct facilities and implement measures to comply with the Maritime Transportation Security Act of 2002 and associated U.S. Coast Guard maritime security regulations designed to protect the Nation's ports and waterways from terrorist attack.
- ***Additional space and an improved berth to support military rapid deployments without conflicting with commercial customers.*** As a critical conduit for military deployment, the POA will need to maintain a sustained commitment that embodies a long-term plan, integrating intermodal efficiency with that of heightened security and positive cargo control. Current berthing facilities at the POA are insufficient to accommodate both military and commercial ships supporting the Alaska-based Stryker Brigade Combat Team. The expansion in facilities and increase in efficiencies are also critical to the POA supporting its designation as the 15th Strategic Commercial Seaport in the Nation for military deployments.

The completed Marine Terminal would include:

- Seven modern dedicated ship berths;
- Two dedicated barge berths;
- Rail access;
- Modern shore-side facilities and equipment to accommodate cruise passengers, cement bulk, POL, roll on/roll off (RO-RO) cargo, containers, general cargo, Stryker Brigade Combat Team, and general cargo on barges; and
- Additional land area to support expanding military and commercial operations.

Implementing the Project would involve two major components and one related activity:

- Continuous expansion onto tidelands and construction of marine structures for berths to accommodate barges and additional RO-RO vessels, a floating dock; a cement berth, two improved POL terminals, three longer berths to accommodate larger container ships, a staging area for Stryker Brigade Combat Team and industrial fabrication, and land for other new or expanded operations.
- Reorganization of the POA system and support structure for loading, unloading, and storage of cargo, and more efficient intermodal freight transfer facilities for commercial and military use. As part of the reorganization, the POA would provide enhanced security measures and improved equipment for loading and unloading containers.

- In a related activity, direct dredging in the harbor area during construction would provide necessary deeper draft for the larger commercial and military ships that must call at the POA in the future.

Construction is anticipated to take approximately 7 years, primarily occurring in summer field seasons, beginning in 2005 to support Stryker Brigade Combat Team deployment needs. After anticipated completion of the construction in 2011, the POA would proceed with operations of the expanded facility for the foreseeable future. However, to continue to supply critical goods to Alaska, operations at the POA must continue unabated during construction. This assessment examines environmental impacts from POA operations.

Discussion

MG Don T. Riley asked Governor Sheffield to describe any additional mitigation and asked if they treat runoff from the new port lands that they have built. *Governor Sheffield* said the answer is yes, and they are spending approximately $10 million on the whole project, but most of it is drainage.

Dr. Billy L. Edge asked if their service area extends down into Canada. *Governor Sheffield* said they do not service anything into Canada, but the port serves everything above Cordova up to the Arctic, across the Arctic, and into western Alaska, and out the Aleutian chain.

Dr. R. Bruce Taylor was interested in their increase in maintenance dredging. He wondered what the operating draft is for vessels and if that has increased in recent years or not. *Governor Sheffield* said that it had and that the need for deeper dredging has increased. They used to dredge to 35 ft, but not go to 39 ft because they have ships coming in that are 37-ft draft, with some military with 38- to 39-ft draft. Also, the tides are so low and so high that they need to maintain that depth on a year-round basis. That is the reason when we started with this project, that was discussed with the Corps, that we go to -45, which essentially would get us to -47, and we dredge the Knik Arm shoal at the same time, but that is three or four years away. This will not be done until the dock is completed, but they have to do construction dredging in the meantime.

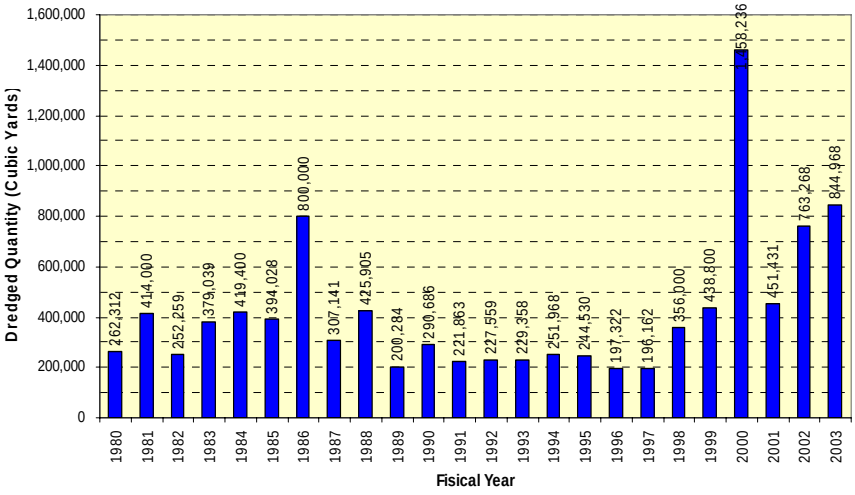
COL James R. Rowan commented that there has been much publicity about the vulnerability of our ports to terrorist attacks. Does the Department of Homeland Security require any special design as ports are upgraded. *Governor Sheffield* said the new Coast Guard regulations went into effect for all ports across the Nation, so they have had to meet those obligations. The port gets involved with the Homeland Security with grant programs, such as for fencing, cameras, motion detectors, etc, so Homeland Security, is involved, but not on a direct basis everyday. We are fortunate to have the MSST, a branch of the Coast Guard, to provide surveillance. As the new port is developed, all areas will be monitored.

Cook Inlet Sedimentation and Modeling

John G.Oliver
John Oliver Consulting
Sherwood, OR

In 2001, a series of studies and a field data collection program was undertaken by the U.S. Army Corps of Engineers, Alaska District, to examine the causes of an extraordinary increase in sedimentation at the Anchorage Harbor dock face. A history of that sedimentation through 2003 is depicted below in graphic form. The sedimentation in 2004 was much more extreme than in 2000.

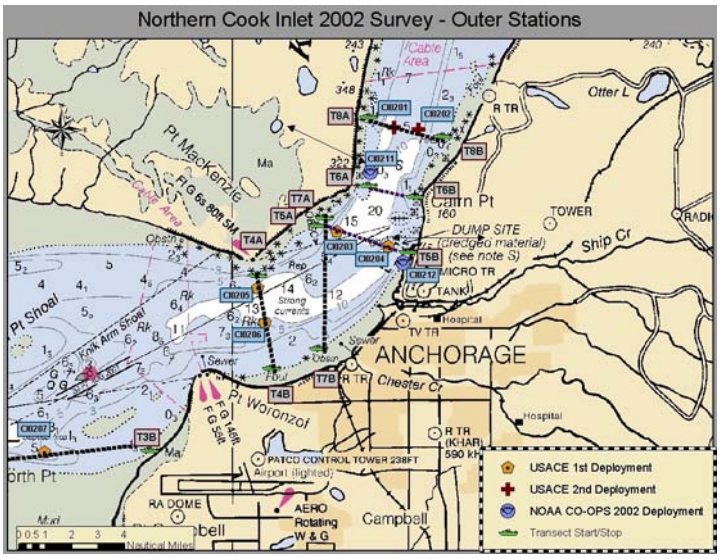
ANNUAL DREDGING QUANTITIES



The program has thus far included a small-scale fixed-bed physical model primarily used to define the roll of headlands and gyres in the development of the systems hydrodynamics. That model is a tabletop device and can only be operated in a steady state mode. An examination of both flood and ebb tides were made by rotating model direction in relation to the forebay and tail race. The model was of such small scale that velocity measurements could not be made within it. Visual interpretations were required to evaluate gyre changes, and rudimentary calculations were made for velocity changes. The model use was expanded to observe the effects of a bridge crossing north of Cairn Point, the McKenzie dock construction, and the port expansion plans. The results from the McKenzie dock and bridge tests were then examined with idealized sections to obtain an outer boundary of impacts.

The second item on the Alaska District's agenda was a massive joint effort between the District and the National Oceanic and Atmospheric Administration to obtain information on the inlets

hydrodynamics so that information could later be used in better understanding the inlets activities. Velocity data were taken on several transects throughout the inlet. A map of some of the transect locations is shown below.



The data set shows a remarkable amount of three-dimension (3-D) activity; however, as no three-dimensional models were available to integrate the information, a two-dimensional (2-D) math model was utilized. The 3-D model has been a tremendous aid in the understanding of the transitory nature of gyres and their roll in the hydrodynamics of the system. The model is very suitable for doing ship simulation studies and could be used to analyze the effect on repletion coefficients in upper Knik Arm if sufficient data is collected to determine existing conditions in that area. Because of the need to integrate the vertical velocity profile in the 2-D model, it is not suitable for tracking sediment movement along the bottom where sediment concentrations and flow directions differ from the averaged flow.

To track transport paths, a three-dimensional distorted scale physical mode has been proposed. The model scales are 1 to 350 horizontal and 1 to 100 vertical. That model has a timeline of about 3 years to complete basic studies. That time allows for collection of additional data, model construction, model verification, and model operation. The price of such a model is about $3 million.

Analytical studies that have accompanied model efforts have consisted of many things. The most dominant of these was an attempt to correlate sediment deposition to the physical parameters existing within the system.

Correlations with water temperature, air temperature, stream flows, and precipitation were not apparent. The spring rise in water temperature above freezing and the fall drop in temperature to near freezing does, however, coincide with the beginning and ending of harbor deposition. The season for normal deposition begins in April and usually ends in early October. A good correlation exists between

extreme tides and harbor deposition for most years, and excellent correlation exists for high tides and deposition in the early part of the deposition season.

The correlation with tides led to a review of the impacts that the tide flats might be playing in the scheme of sources and sinks. It is believed that fall freezing temperature may harden the upper tide flats and that ice coverage and the lack of thermal conditions that would allow thawing keep them in an erosion resistant state until spring warm-up. During the spring, the freeze expanded soil become vulnerable to rapid erosion and large amounts of sediments are released to the system. That premise can explain the prefreshet rise in sediment loading, but does not explain the continuous deposition that occurs before during and after freshet passage. The storage and flushing characteristics of the zone of interest were examined to see if answers might lie there

The tidal prism was compared to the freshwater inflow from the Knik and Matanuska rivers, and it was found that freshwater flows, even during peak freshet conditions, were less than two or three percent of the tidal prism upstream of Point Woronzof. When the freshwater flow was compared to the prism and the residual storage within the inlet above Point Woronzof, it was found that at least 60 tide cycles are required to flush the system. Because of this, it is presumed that any suspended sediments released in the system are retained for extended periods of time. This retention of a slug of water was also examined for several tide cycles in the math model, and it was found that there was little net movement of the slug through the system. Retention within the system can explain the carryover of deposition between major excitations.

The hypothesis that sediments when entrained in the system remain in the system for long periods can also be used to explain the severe increases in sedimentation seen in the 1996 rise in deposition during cable crossing construction and during the various phases of the McKenzie dock construction beginning in 2000.

To strengthen these conjectures about sedimentation at and to understand the impact that modifications to the system might have on this and other important parameters, several recommendations are made.

- Define the topography in upper Knick Arm.
- Measure suspended sediment loads on a continuous basis through the deposition season.
- Refine the 2-D model to reflect true flow values into and out of Knick arm.
- Develop a three-dimensional model.
- Measure the extent and depth of upper bank freezing.
- Measure shear stress required to mobilize upper bank sediments when frozen and immediately after thawing.

Discussion

MG Don T. Riley asked Mr. Oliver if his 3-D model was a moveable bed model. *Mr. Oliver* answered that it was a 1/350 horizontal scale and 1/100 vertical scale fixed-bed model located in Vicksburg, MS.

BG Robert L. Davis commented that the Los Angeles District used that particular building in Vicksburg for a $450 million construction project, and because of what the model indicated, approximately $200 million was saved. Therefore, in some cases that $3 million cost up front is scary; you can save much money and pain if you are willing to make the investment. *Mr. Oliver* agreed. He said that he had worked with models for close to 40 years, both physical and numerical, and he had never seen one that did not return your investment several fold.

BG Merdith W. B. Temple asked what was the status of the funding of the $3 million. *Mr. Oliver* deferred the answer to Mr. Kenneth J. Eisses. *Mr. Eisses* answered that it was their understanding that the model had been approved in language, but the funding had not been appropriated to date. *BG Temple* asked if it was in the new WRDA that is being worked now. *Mr. Eisses* did not believe it was.

Alaska District Dredging Program

E. Allen Churchill
U.S. Army Engineer District, Alaska
Anchorage, AK

Introduction

The U. S. Army Corps of Engineers has been dredging harbors and channels in Alaska since the completion of the Nome Harbor in 1918. The work was accomplished by a work force of engineers, technicians, surveyors, mechanics, vessel operators, and a small fleet of clamshell and hydraulic cutterhead dredges. Initiatives to privatize Government functions began in the late 1970s and early 1980s with an onslaught of commercial activity studies designed to evaluate which Government services could be contracted to the private sector at a savings to the American taxpayer. This led to the elimination of three Corps-owned dredges and their support vessels owned by the Alaska District in the late 1980s and early 1990s. Two of these vessels remain in Alaska today, owned and operated by local contractors. The Corps of Engineers still operates a minimum dredge fleet stationed across the country to meet Department of Defense (DoD) requirements for channel maintenance during military mobilizations, locally and overseas.

The Corps Civil Works Program

The Corps of Engineers provides engineering design and construction management services to the Nation. Its mission is categorized under three general categories: military, civil works, and work for others. Within the civil works program, there are three general appropriations used to fund large civil works projects. The General Investigations appropriation is used to study project needs and alternatives, perform economic feasibility studies, and secure a commitment from the local sponsor for cost-sharing purposes. Once Congress authorizes a project, funds can then be requested in the Construction General appropriation to construct the project. This appropriation, along with local sponsor, contributed funds completes the initial construction of the project. Following the construction phases, the Operations and Maintenance (O&M) program commences to provide necessary funds for maintaining the project according to the terms specified in the Project Cooperation Agreement with the local sponsor. The O&M appropriation has traditionally funded the bulk of the Alaska dredging program, although in FY04, 41 percent of the total dredging effort came in the form of new projects around the state under the Construction General appropriation.

Determining Dredging Needs

Dredging in Alaska initially begins as a navigation feature at the site of a new boat harbor or navigation channel. New projects undergo a rigorous process of initial planning, feasibility study, and

design before construction can begin. The Alaska O&M program provides maintenance on 45 channel and harbor projects and a full-time operating flood-control project. It also monitors the condition of 13 locally maintained flood-control projects. Five harbors are dredged annually with dredged material quantities averaging over 2.5 million cu yd per year. Nonannual projects are surveyed every 3 to 5 years, depending on shoaling patterns and past history of maintenance needs. Hydrographic surveys are the most widely used method of determining project condition, although emergencies resulting from floods, earthquakes, tsunamis, etc., automatically qualify a project for immediate inspection for damages. Telephone contact and written correspondence from users, harbormasters, and other local officials are also used to assess the severity of the problems and assist in the budget priority process. The highest priority is given to harbors with high shoaling rates and heavy traffic, followed by smaller, less active harbors where sufficient dredge quantity exists that it can be economically removed before severe impediments to navigation occur.

The Project Execution Process

Nonannual maintenance projects are budgeted over a 2-year process with the first year reserved strictly for acquisition strategy, initial plan, and specification development, along with environmental evaluations and approvals. Dredge material and disposal sites require sampling, testing, and analysis to determine acceptability of the disposal site for receiving the material. The second year of funding allows for the contracts to be advertised and awarded in order to perform the required dredging. Annual dredging projects require the same environmental clearances but will often have longer duration permits. The environmental work for the future year's dredging on annual projects will coincide with the current year work to allow for timely contract renewal.

Alaska Dredging Projects

The dredging program in Alaska, like other places in the world, has its unique set of challenges. With 44,000 miles of coastline compared to 42,000 miles for the remaining 49 states, expensive equipment mobilization costs, large tide ranges, abundance of glacial silts, and limited construction season due to either climatic or environmental windows; dredging in Alaska requires careful and thorough planning. Dredging can generally occur in the southeastern part of the state during the winter months whereas projects from Homer north are limited to either dredging during the open water season or during extreme winter conditions when ice is frozen sufficiently thick enough to support dredging equipment. Following is a short synopsis of some of the more recent dredging projects in Alaska and the unique challenges they present.

Anchorage. A DoD strategic port and critical supply hub for 90 percent of the population of Alaska, this port is the priority dredging project in the state. The annual dredging period is from 15 May to 1 November via contract for a hopper and clamshell dredge. The 2004 dredging season quantities

exceeded 2 million cu yd at a cost of nearly $11 million. The mean tide range is 25.9 ft with an extreme of 40.7 ft. Using survey-to-survey differences, shoaling rates in front of the port have been calculated as high as 19,000 cu yd per day during July and August.

Homer. This harbor serves as a harbor of refuge to over 1,500 vessels, extends the fishing season an extra 4 months each year and is an integral part of Homer's economy. The annual dredging period is the first week of September following the Labor Day holiday via contract for a hydraulic cutterhead/pipeline dredge. The 2004 dredging season quantities exceeded 7,800 cu yd and cost $192,000. A Dredge Material Management Plan is currently being conducted to identify a new confined disposal site for future dredging needs.

Homer Coast Guard Dock. The annual dredging period occurs twice annually for the U. S. Coast Guard, once in April, and again in September following the Labor Day holiday via contract for a hydraulic cutterhead/pipeline dredge. The 2004 quantities dredged exceeded 10,800 cu yd at a cost of $458,097.

Dillingham. Commercial fishing is the cornerstone of Dillingham's economy and this harbor provides half-tide access and all-tide moorage for about 320 commercial fishing and recreational craft. The annual dredging period occurs during the month of June via contract for a hydraulic cutter head/pipeline dredge. The 2004 quantities dredged reached 90,000 cu yd at a cost of $356,653. A Dredged Material Management Plan is currently being conducted to identify a new confined disposal site. An in-water disposal test is scheduled for this June to determine if dredging can continue without having to place dredged materials on adjacent wetlands.

Ninilchik. An important harbor of refuge for the lower Cook Inlet commercial fishing fleet, this harbor provides protected moorage with half-tide access for 32 vessels. The dredging period occurs during the first 3 weeks of May with average annual dredge quantities of approximately 9,000 cu yd costing $149,000 to remove.

Nome. Alaska's northernmost annual dredging project serves as a transportation, general business supply, and cargo distribution center for the Seward Peninsula since access to this area is only by air or sea. The dredging period occurs during the month of June with average annual quantities of 7,000 cu yd costing $312,000 to remove. This project was originally authorized in 1917 and is currently undergoing a major renovation with construction of a new entrance channel and breakwater and the decommissioning of the old project to be complete in 2005.

Bethel Small Boat Harbor. The only protected harbor in the Kuskokwim River Delta area, this project provides beach moorage to over 1,200 small boats used for subsistence purposes. The harbor is dredged on a 7- to 10-year frequency during the late winter months when the ice is thick enough to

support conventional excavation equipment. It was last dredged in 1997 when 28,300 cu yd of material was removed and trucked to a nearby upland disposal site.

Chena River. Dredging portions of the lower Chena River was performed in the winters of 1999 and 2000, under a one time authorization to remove 105,657 cu yd of gravel that was impeding the safe navigation of a local tour boat company during the summer. Work was performed using conventional excavation equipment from the ice with material stockpiled, dewatered, and hauled by dump truck to an upland site at the Fairbanks International Airport for runway construction.

Wrangell Narrows. Originally constructed in 1934, this 24-mile-long channel carries a major portion of all the commerce to southeast Alaska circumventing the need to travel in 90 miles of hazardous seas. The channel was last dredged during the winter of 2000-2001 where nearly 34,000 cu yd was removed. Some areas required blasting to remove rock that uplifted from this tectonically active area.

Discussion

Dr. R. Bruce Taylor asked what are the environmental compliance requirements that define your dredging window in Alaska. *Mr. Churchill* answered that it varies from one part of the state to the other depending on the fish populations, fish patterns, migration patterns, so it varies from one project to another. In the northern part of the state we do not like to dredge in the wintertime because of the cold. In the southeastern part, we can dredge anytime, but you still have out-migrating fish in the spring, and you do not want to disturb the nesting areas of the eagles. Dredging in the southeast works better from November through February. In Anchorage, there is no constraint, but we have to watch for the belugas.

BG Robert L. Davis asked if they had ever done an economic analysis at overdredging the harbors so that they would not need to be dredged but every other year. *Mr. Churchill* answered that they had not done a study to see if they could skip a year. However, in the 1980s, Nome had an environmental problem with some heavy metals, and they were not allowed to dredge for a couple of years, and that really hampered them. They resolved that by depositing and digging deep into the turning basin and burying those contaminated sediments. We like the multiyear contracts and combining projects under one contract to eliminate the effort that it takes to put a contract on the street and get it awarded because it runs between $75,000 and $100,000 each time, and that is expensive. Dillingham Harbor can never pass more than a year and 6 months. Right now boats are on their sides because of the low tide, so that is a safety factor. The same is with the entrance channel at Ninilchik. It is a half-tide harbor to start with. *BG Davis* asked about the cost per cubic yard to dredge. *Mr. Churchill* said that it varied. At Anchorage, it runs between $4 and $6 a yard, but where they have to mobilize equipment at some of the nonannual projects, it could be between $40 and $50.

Dr. Billy L. Edge asked where the disposal site was located for the Anchorage dredging and if they do post-disposal surveys to see how long that material stays there. *Mr. Churchill* answered that it was located about 3,000 ft southwest of the south end of the port, out in the deepest part of that channel. He added that they do not do post-disposal surveys.

Mr. Charles B. Chesnutt asked why the sedimentation is increasing and we are getting these spikes. *Mr. John Oliver* stated that the simple answer is we do not know. The more complex answer is that somehow or other there is increased sediment, probably out at the system, and there is a change in the gyre formations that bring in sediment to the dock. *Mr. Chesnutt* stated you now have more material delivered right to the doorstep of the harbor or the port development process, so you have material that can be used for expanding the port. Is this being looked at? *Mr. Oliver* did not know. He said that he would imagine that the material that is there will be used in port expansion. It does consolidate reasonably fast, and if you have time to drain it, it probably is a construction material.

Mr. Stanley J. Boc asked Mr. Oliver that based on his particle trait diagram and where they are placing their dredged material, only 3,000 ft southeast of the harbor, is there a chance that it is just all going back in the harbor. *Mr. Oliver* said that you have to weigh more things than is it coming back to the harbor. There is not a simplistic answer.

Ms. Joan Pope asked Mr. Churchill that with this increased dredging that they have had to deal with, has anyone looked at where that material is? Have you looked at patterns? Is it related specifically to shoaling locations, or is it located to a general shallowing in the areas you are responsible for dredging? Also, have you looked at the grain size and whether there has been any transition of the grain size of material you are dredging? *Mr. Churchill* began with the placement of the material and the shoaling. We tried some cross-sectional survey several yeas ago and have tried to do this every year in support of the tabletop model. The material primarily comes in from the north and the south to form the two shoals and eventually meet in the middle. We have not done a massive investigation. NOAA data may give us an indication as to what is happening on that scale. In terms of particle size change, we do know it changes from the south and to the north. The material is different. It is harder to dig on the north end.

Mr. Harvey N. Smith asked if the particle size moving in as bed load or suspended and then settling out. *Mr. Oliver* replied that the material is primarily silts, and there is very little bed load involved. *Mr. Smith* wondered if the physical model was going to be able to look at the sedimentation. *Mr. Oliver* stated that the sediment transport here is extremely complex. You do not have a fixed target anywhere in the system. The most we are going to do with a physical model is define the hydrodynamics and work with that to analyze sedimentation. There is no such model that can handle this type of sediment transport.

Subsistence Harbors in Alaska

Kenneth J. Eisses
U.S. Army Engineer District, Alaska
Anchorage, AK

The Alaska District has built over 40 small boat harbors throughout the state. The majority of these harbors have been built in southeast and south central Alaska, and partway out the Aleutian chain. Few small boat harbors have been built on the west and north coasts of Alaska. A small boat harbor generally provides safe moorage for vessels under 20 ft of draft and less than 180 ft in length. Alaska harbors are predominantly working harbors, and the majority of these vessels are used for commercial purposes, such as commercial fishing, charter trips, water taxis, recreation and tourism, water access, or a combination of these. On the other hand, subsistence vessels are generally 18 to 30 ft in length with a draft of 2 to 3 ft. They are generally stored on trailers or in out-of-the-way places for safety and hand-launched off the beach. They must be pulled up out of the water due to ice in the winter. The majority of vessels needing harbors in and on the west and north coasts of Alaska are of this type.

Harbor fleet characteristics are usually composed of commercial vessels (fishing vessels, tugs and barges, tenders, and charters), subsistence boats, and recreational boats. The majority of Alaska harbors are economically justified on commercial fishing vessels with some benefits being obtained from subsistence, and in some instances, up to half from recreation. Under Federal budgetary rules, commercial navigation is a high priority output, while recreation and subsistence are not. The practical implication is that projects that produce predominantly low-priority outputs are typically terminated early in the development process.

While not oriented toward commerce, subsistence is the economic basis of many rural Alaska communities, mostly in the western and northern part of the state. Subsistence is defined as customary and traditional, noncommercial uses of wild resources for a variety of purposes. These include harvest and processing of wild resources for food, clothing, fuel, transportation, construction, arts and crafts, sharing, and customary trade. As such, subsistence cuts across native cultures and is significant to survival well beyond basic food needs. (Def AK Dept of Fish & Game, Div of Subsistence.)

Boats are an integral part of all subsistence activities in rural Alaska. Communities are not connected by roads, and overland travel is hindered by bog-like conditions on the tundra during the most productive times of year. Rivers are used as transportation corridors to reach traditional subsistence grounds for fishing, hunting, and gathering, and vessels are used as a means of transportation the way cars are used in the Lower 48. Research shows that subsistence harvests increase with distance from the road

system and the urban centers of south central and southeast Alaska. Harvests are particularly large on the western and northern coasts where they can be 2 to 4 times the statewide per capita average of 375 pounds annually. Weather conditions often limit vessel launch opportunities, thereby delaying subsistence trips and further reducing the productive time available for harvesting.

Of the recently authorized and/or constructed projects (Wrangell, Seward, Nome, Haines, Unalaska, Akutan, and Douglas), only Haines included subsistence benefits. Haines subsistence benefits amounted to approximately $200,000 out of a total of $1.5 million annually.

All harbors facilitate subsistence activities, but most are feasible without the additional subsistence benefits. Given the difficulty of forecasting the increased harvest, it is frequently decided that scarce study dollars will not be used to quantify subsistence benefits. For many other projects that have been terminated for lack of Federal interest or for lack of a non-Federal sponsor (Wainwright, Quinhagak, Chefornak, Elim, Teller, Kokhanok, Igiugig, etc), subsistence is a much larger component of the expected benefit of the proposed project. Those harbor locations are generally in western Alaska on the Bering and Chukchi seas.

The study at Wainwright typifies our experience with many rural Alaskan villages on the western and northern coasts. The boats owned and used by Wainwright residents are predominantly open skiffs, typically 16 to 20 ft long with a few larger boats. The community has a boat launch, so they are able to launch and haul out their vessels rather efficiently, negating the usual practice of manually dragging boats up onto the beach. The boats are stored on trailers and launched as needed for subsistence activities. However, the launch is unprotected, and residents experience problems in using the boat launch during periods of high wind. The study team evaluated wind data for the region and developed a wave model to assist in defining the degree of constraint imposed by current launch ramp conditions. The summer months are the most important time for subsistence production, yet wind conditions that create difficult launch and haul out conditions occur up to 30 percent of the time during those months. A harbor would help increase benefits by offering a protected launch area at times of high wind and wave conditions. The annual harvest of subsistence goods has been valued at slightly more than $2 million; therefore, a proportional increase in harvest due to reduced launch restrictions could reduce the community's costs for store-bought foods by as much as $600,000 a year. This created a benefit to cost ratio of more than 6 to construct a launch ramp and provide wave protection. To dredge a basin and a channel produced a benefit to cost ratio of 0.4. Headquarters terminated this study because it would not produce high priority outputs.

The relationship between subsistence activities and store purchases is also important in rural Alaska communities. Subsistence activities are central to the culture of these communities, emphasizing the value of family and the importance of sharing. In general, paying jobs are few; therefore, disposable cash

is limited and subsistence is viewed as the work of the community. The projects that have been authorized are largely cash-based economies, while the struggling projects are in mixed economies where cash income is minimal and subsistence is the predominant activity of the population.

The Corps may have increased opportunities to build harbors to support predominantly subsistence-based communities if recent legislative proposals are passed. Congress included language in the 2003 and 2005 draft WRDA bills to address the justification of Federal interest in harbors in remote maritime communities. The impact to the project funding process is unclear, but such language would likely increase the number of recommendations to construct small harbors in subsistence-based communities.

Often, the appropriate project for these communities would be small in size and have few features other than a protected launch and limited moorage space. Due to the shallow draft of the subsistence fleet, dredging would be minimal; consequently, life-cycle maintenance costs would be relatively low. In general these projects would be in the $3 to $4 million range. They would have a high mob. -demob. cost, limited dredging, and some rock work for wave protection. Any floats would have to be pulled before winter ice set in and put back each spring. These harbors would be simple engineering challenges that would greatly increase the ease of life in these villages. The ability to launch and retrieve or store vessels in a protected harbor would greatly benefit these villages.

(There was no discussion following this presentation.)

Public Comment

There was no public comment.

Board Recommendations/Closing Remarks

Dr. R. Bruce Taylor thanked all presenters for a wonderfully educational couple of days. He stated that it was fascinating flying to Nome and seeing the countryside. It is a very dynamic system, and while it has many unique characteristics, there are also some similarities, particularly in the coastal dynamics, to other parts of our Nation. He encouraged the Alaska District to take advantage of and draw upon the expertise in other Districts. He stated that there is a great wealth of experience and knowledge in the Lower 48 that would greatly benefit, enhance, and accelerate the success of the Alaska District in addressing some of the issues seen and discussed.

BG Merdith W. B. Temple thanked the Division and District staff for their support, the speakers, and participants. It had been a great learning opportunity for him. It gave him a feel for just how large and complex and the level of variety of issues that the District faces in the northern Pacific and, most particularly, in Alaska.

Dr. Billy L. Edge also expressed his extreme gratitude for those people who have worked with us, to inform us, and enlighten us with some of the opportunities and challenges in Alaska. He reiterated what Dr. Taylor expressed that it is certainly like some of the Lower 48, but there is so much that is different. There are muddy coasts and heavy dredging issues in Texas, and there are muddy coasts and some dredging issues in Alaska, but there are some things that are really special and especially different, such as cultural issues, economic issues of projects and trying to get them funded with the policies and the laws that we work with around the country, but don't always seem to work. How you actually get beyond that, whether it is more data systems, but it is not the physical and the scientific challenges, as much as it is some of the other issues that come before us in trying to solve some of these problems.

Dr. Joan Oltman-Shay thanked all for the excellent presentations as well. She commented that when the meeting was being planned, CERB worked with many in trying to identify topics of interest and of concern for both Alaska and Hawaii. (1) One was preparedness for the future tsunami and areas of responsibility, (2) coastal erosion in Hawaii and Alaska, (3) socioeconomic impacts of climate change on the native Alaskan communities, and (4) navigation project design construction and maintenance. She added by stating the presentations had been fantastic, and they certainly addressed those areas of interest. She said that she was sure everyone was wondering, "What does CERB do with all this that you have given us?" She continued by stating that the CERB is a forum by which we go out to the field and we learn from you, you in the field who are getting your hands dirty trying to solve real-world problems in the immediateness of those problems. We learn from you. That learning, through time, translates to help for you. That is the intent. Most immediately, we strive to connect you with tools, be they models or methodologies, and data that we know from our travels throughout the Nation that could be available.

You might not be as aware of them. That is the most immediate, and hopefully you will benefit from that. In the longer term, we look for ways to help you work your problems more easily through the Federal system. We have learned some very unique things here that in the Federal system sometimes does not work for you. So, that knowledge, taken back by us, perhaps we can help you work through the system or the existing system we have. Also on the longer term, we learn from you things that we need to consider steering the processes towards to better work for problems like you have in Alaska and Hawaii, things we are not doing the right way now. These take a little bit longer. She offered Regional Sediment Management (RSM) as an example because the RSM Program is a new way that the Corps is looking at projects. In the past, the Corps looked at projects in isolated format. Now the projects are looked at in terms of the watershed and the littoral cell it is sitting in, and also in terms of how one project can benefit from another project, leveraging dollars. The concept of RSM was developed through CERB. The seeds were set through this type of dialog, and it has been nurtured along through this continued dialog, through the CERB, and now we are seeing its time has arisen, and it is being embraced by the Ocean Commission Policy Report to the President of the United States. It is your dialog that will also evolve the Army Corps into the future, so you can feel very good about the time you have spent here, and this dialog is invaluable and should continue.

BG Michael J. Walsh added his appreciation to BG Davis and COL Gallagher and their staffs. This was his first trip to Alaska. He had seen many issues before working as the Executive Director for Civil Works, but it was always good to see folks eye to eye and talk to them to see exactly what their issues are and then visit and see what some of those issues are. He had not thought about what global warming is doing on ice armoring in Alaska, and so there are a lot things to think about until the next meeting. He added that certainly the social impacts of the infrastructure in Alaska and how those social impacts will affect not only subsistence villages, but also how we are going to work those particular items from a national perspective, and how that will affect the policy issues as we look at our national economic development process and relate that national economic development process to a regional development process and then also aggregate that into the social priorities.

BG Robert L. Davis stated that he learns something new all the time, but not having the educational and technical background other than experience as Commander of the Los Angeles District and South Pacific and Pacific Ocean Divisions, he did not think he had ever learned at a more rapid rate than the 4 years that he had served on CERB. He thanked all who participated in his learning experience and challenged everybody who attended CERB meetings to join into the discussions and to make your experience an investment. Share what you have learned with the rest of the coastal engineering community. He concluded by thanking the Alaska District for their help with the meeting.

MG Don T. Riley stated that besides the many scientific and engineering facts learned this week, it has been learned that the Corps does not do anything by itself. The Corps tries to reach out to states, as the leaders in water resources, and local partners, both private, nongovernmental, and governmental, and work in broad coalitions. Therefore, the Corps sees itself as a large partnership. We look for innovative approaches, and that is why we think that coalitions are better for that kind of result because you are able to tap into ideas that are out there and the learned knowledge throughout the Corps, the Nation, and internationally, as well. We have seen that there is just as much art as science in this business as you get into the policy business, and it is a challenge. We are in a time of constrained budgets because the Nation is at war. There is much demand on the Federal budget, so we have to continue to do what we think is best and speak up for your interests and understand that the Corps is in a position to try to balance many competing alternatives and requirements. *MG Riley* thanked BG Davis for providing the Division and District team to help with the meeting. He thanked COL Timothy Gallagher and his staff, Bruce R. Sexauer, Mary Wilson, Merlin Peterson, Pat Richardson, Chelan Schreifels, and Ken Eisses. He also thanked Charles B. Chesnutt from Headquarters, COL James R. Rowan from the U.S. Army Engineer Research and Development Center, Thomas W. Richardson and Sharon L. Hanks from the Coastal and Hydraulics Laboratory, and Susan Soderberg, for taking the verbatim transcription.

COL James R. Rowan then adjourned the 79th meeting of the Coastal Engineering Research Board.

Appendix A

79th Coastal Engineering Research Board Meeting
Executive Session
Anchorage, AK
6 and 9 June 2005

ACTION ITEMS

Number	*Title*	*Description*	*Responsible Agent*	*Action Officer*	*Status/Notes*
79-1		Examine issue of Socioeconomic impacts of climate change on native Alaskan communities and determine if we make recommendations relative to this to the Chief of Engineers.	USACE/IWR	Chesnutt	
79-2		Prepare response Chief's Charge as to what is going on now with such elements as the Great Lakes, Louisiana Coastal Area, Gulf of Mexico.			
79-3		Develop commitment in FY 07 budget for CFDCP plus up.			
79-4		Regional Sediment Management Committee to report to CERB via VTC or intermediate meeting.	ERDC/IWR	Pope/ Chesnutt	
79-5	Future CERB in Holland	Possible CERB meeting in Holland to observe what is going on in Europe.	IWR	Chesnutt	
79-6	Ocean Commission Report	Instill better collaboration between other Federal agencies and POH/POA. MG Riley to assist from top down, Districts to work from bottom up.	HQ,USACE/ IWR/POH/ POA		
79-7		Set up meeting with Vice-Admiral Conrad Lautenbacker to discuss IOOS and AOOS.	HQ,USACE/ IWR	Chesnutt	
79-8	80th CERB	Fall 2005 a. Site/Date– St. Petersburg, 3-4 November 2005 b. Focus – Shore Protection, S3P2I, Florida hurricanes, RSM and IOOS tie in Florida and Gulf, USGS coordination and other Federal agencies and Clean Beaches Council.	ERDC/CHL/ IWR	Pope/ Chesnutt	Meeting will follow Sustainable Beaches Conference. Location is St. Petersburg Hilton.
79-9	81st CERB	Meeting in Vicksburg, MS. Include EAB	ERDC	Pope/ Chesnutt	Scheduled for 17-19 July 2006.

COASTAL ENGINEERING RESEARCH BOARD
REPORT TO THE CHIEF OF ENGINEERS

28 February 2006

The Coastal Engineering Research Board met in Anchorage, Alaska, in June 2005. The regional needs and challenges of this vast coastal state with the longest coastline of any state are most significant.

From the diverse challenges facing the Alaska and Honolulu Districts, we recommend the following research needs as particularly important to consider in developing your future research directions:

1) The effects of global warming are already quite startling in the Arctic region; primarily because ice coverage at the shoreline has been shortened by a few weeks. This lack of natural protection during the early part of the fall storm seasons on the Bering Sea and the Arctic Ocean has caused alarming rates of coastal erosion on these shores. Not only is shoreline erosion adversely affecting vast expanses of natural habitat, but the subsistence hunting and fishing communities are losing homes, roads, and other property and infrastructure. Research on the climatology, meterology, oceanography, and geomorphology of this region is of the utmost importance to define more precisely the design parameters for shore protection measures.

2) These erosion problems are compounded by the severe shortage of the normal construction materials and equipment for shore protection projects. Further research must be initiated if we are to find cost-effective engineering solutions. The cost of building new schools, clinics, and, more importantly, airfields make the relocation option much less economically viable. The subsistence economy of these communities requires that they remain in reasonable proximity to the coast. Research should be conducted on both innovative construction materials as well as innovative construction methods. This research should pursue the applicability of the Army's mobile infrastructure technology to these extreme climatic circumstances. Research on the social/cultural benefits related to native Alaskans and the problems related to identifying and analyzing cost-effective solutions for a subsistence economy in a national economic development "world" is sorely needed. Our current methods for benefit analysis just don't apply.

3) With population growth creating a need for large infrastructure projects, particularly in the Anchorage area and along the Cook Inlet, the need for high quality numerical models of the hydrodynamic and sedimentary processes is paramount. But, good models must be supported

with extensive data collection programs if they are to be useful. The Corps needs to expand its wave gauging efforts in this region and should be working to increase the hydrologic data collection efforts of the National Weather Service and the sedimentary processes and geomorphology programs of the U.S. Geological Survey.

DON T. RILEY
MG, US Army
President

DR. BILLY L. EDGE
Texas A&M University
Member

ROBERT L. DAVIS
BG, US Army
Member

DR. JOAN OLTMAN-SHAY
Northwest Research Associates
Member

MERDITH W. B. TEMPLE
BG, US Army
Member

DR. R. BRUCE TAYLOR
Taylor Engineering, Inc.
Member

MICHAEL J. WALSH
BG, US Army
Member

Appendix C
Biographies of Board/Speakers

Dr. David E. Atkinson

Dr. Atkinson is currently an assistant professor at the University of Alaska, Fairbanks, jointly appointed between the International Arctic Research Center and the Department of Atmospheric Sciences, where he works on coastal climate and meteorology issues in the circum-arctic, including application of model results, focusing his efforts on supporting the Arctic Coastal Dynamics project (Alfred Wegener Institute, Germany). Previously, he held a National Science and Engineering Research Council post-doc with the coastal group at Bedford Institute of Oceanography, Halifax, Nova Scotia. He received his Ph.D. degree from the University of Ottawa, focusing on improving climate detail in the Canadian Arctic Archipelago. His M.S. and B.S. degrees, both from Carleton University, focused on satellite remote sensing and ground thermal regime issues, respectively, in the Canadian High Arctic.

Taylor Brelsford

Mr. Brelsford is a cultural anthropologist and Subsistence Coordinator for the Bureau of Land Management (BLM), Alaska. He serves as the senior specialist on subsistence issues for Mr. Henri Bisson, the BLM State Director for Alaska. His duties include regulation and policy development, state-Federal coordination, and works with rural Alaskans to implement the Federal subsistence priority. A long-time Alaskan, Mr. Brelsford received his undergraduate education at the University of Alaska, Anchorage, followed by graduate school in Canada. He holds a master's degree from McGill University and is completing a Ph.D. dissertation on subsistence protection and co-management regimes with McMaster University in Ontario, Canada. During the 1980s, Mr. Brelsford worked as the Natural Resources Director for the Kuskokwim Native Association in Aniak and taught natural resources management for the Rural College of the University of Alaska, based at the Bristol Bay campus in Dillingham. He came to work with the Federal subsistence program at the U.S. Fish and Wildlife Service in 1992, first as a regional anthropologist, and then supervising the public involvement division. He has worked with the BLM in his current capacity since 2001.

E. Allen Churchill

Mr. Churchill is the Chief of the Operations Branch at the Alaska District Corps of Engineers. He came to the district in 1981 from the University of Idaho, where he received his M.S. degree in Agricultural Engineering. Prior to that, he studied at the University of Delaware, where he received his

B.S. degree in agriculture in 1978. In his 24 years with the Alaska District, he has worked in the Flood Plain Management Section, Hydraulics and Hydrology Section, Project Management, Information Management, Contracting Division, Regulatory Branch, and the Operations and Readiness Branch, where he became the branch chief in 1993.

BG Robert L. (Larry) Davis

BG Davis became the 24th Commander and Division Engineer of the Pacific Ocean Division (POD), U.S. Army Corps of Engineers, headquartered at Fort Shafter, HI, on 9 June 2003. He is responsible for a mission that includes engineering design, construction and real estate management for the Army and Air Force in Hawaii and Alaska and for all Department of Defense agencies in Japan, in the Republic of Korea, and Kwajalein Atoll, Marshall Islands. His Division administers the Corps' Federal water resource development program and regulatory program governing work in waters and wetlands in Alaska, Hawaii, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. It also undertakes projects on a reimbursable basis for other U.S. government agencies and Pacific island nations.

After assuming command of POD, BG Davis deployed to Iraq for 6 months as the C7 (Engineer) for CJTF-7 during Operation Iraqi Freedom and was dual-hatted as the Commander, Iraq Provisional Command, Baghdad, Iraq. Prior to assuming command of POD, BG Davis commanded the Corps' South Pacific Division for 2 years. Previous Corps assignments also include Chief of Staff at Headquarters, U.S. Army Corps of Engineers, Washington, DC; and Commander and District Engineer of the Corps' Los Angeles District.

BG Davis was commissioned in the U.S. Army Corps of Engineers in June 1974, following graduation from Auburn University with a bachelor's degree in industrial engineering. He later received a master's degree in operations research from Georgia Tech. He is a graduate of the Army Command and General Staff College and the Air War College.

Field assignments include Platoon Leader and Company Executive Officer, 249th Engineer Battalion, Karlsruhe, Germany; Company Commander and Battalion S4, 11th Engineer Battalion, Fort Belvoir, VA; Battalion S3 and Executive Officer, 326th Engineer Battalion, 101st Airborne Division (Air Assault), Fort Campbell, KY; Group Engineer, 5th Special Forces Group (Airborne), Fort Campbell, KY, in Saudi Arabia and Kuwait during Operations Desert Shield and Desert Storm; and Commander, 43rd Engineer Battalion, Fort Benning, GA, which twice deployed to Somalia.

BG Davis also served as the Director of Tactics, Leadership and Engineering for the U.S. Army Engineer School; as an Action Officer on the Army Staff; and as the U.S. Army Exchange Officer to the

Australian School of Military Engineering, in Sydney, Australia, and Chief of Staff, U.S. Army Maneuver Support Center and Fort Leonard Wood, MO.

His decorations and awards include the Legion of Merit (five awards), the Bronze Star Medal (two awards), and the Parachutist and Air Assault badges.

Bruce A. Ebersole

Mr. Ebersole received a Bachelor of Science degree in civil engineering from the University of Delaware in 1977. He received a master's degree in civil engineering from the University of Delaware in 1979, with an emphasis on coastal engineering. His thesis topic was "Modeling of Nearshore, Wave-driven Circulation." Mr. Ebersole began his career at the U.S. Army Engineer Waterways Experiment Station (WES), Hydraulics Laboratory, in 1979, and moved with the Research Division of the Hydraulics Laboratory into the Coastal Engineering Research Center (CERC), when it relocated to WES in Vicksburg. Topics of study were: storm surge, wave transformation and coastal circulation, coastal sediment processes, and numerical modeling. He moved up through the engineer/scientist ranks in CERC, then with the combined Coastal and Hydraulics Laboratory (CHL). Mr. Ebersole became Chief of the Coastal Processes Branch in 1988, and served in that capacity through 2004. He was promoted to his current position as Chief, Flood and Storm Protection Division of CHL in 2004. Mr. Ebersole coaches competitive swimming on a volunteer basis at a local high school, and is involved in many school and extracurricular activities.

Dr. Billy L. Edge

Dr. Edge is a professor of Ocean and Civil Engineering at Texas A&M University; Head, Ocean Engineering Program; and Co-Director, Texas A&M Center for Texas Beaches and Shores. He has B.S. and M.S. degrees in civil engineering from Virginia Polytechnic Institute and a Ph.D. degree in civil engineering from Georgia Institute of Technology. Prior to his current position at Texas A&M University, Dr. Edge worked extensively in the private sector, and was a professor at Clemson University.

Dr. Edge's professional interests lie in coastal engineering, dredging technology, coastal-zone management, hydraulic engineering, and water quality modeling. He has performed extensive research in applied hydrodynamics, coastal structures, dynamic coastal processes, mathematical modeling of natural systems, marine pollution control, physical modeling of hydraulic phenomena, sediment transport, and estuarine analysis.

Dr. Edge has published extensively with over 100 publications and has made numerous conference presentations both nationally and internationally, including Spain, Japan, Germany, Australia, South Africa, The Netherlands, Italy, Taiwan, and Canada.

Dr. Edge has achieved worldwide eminence. He has received the International Coastal Engineering Award in 1997 from the American Society of Civil Engineers (ASCE); the W. H. Bauer Professorship in Dredging Engineering in 1994, Texas A&M University; the Morrough P. O'Brien Award in 1993 from the American Shore and Beach Preservation Association (ASBPA); and the Arthur M. Wellington Price in 1983 from ASCE. Dr. Edge is a member of ASBPA, ASCE, Florida Shore and Beach Preservation Association, International Association for Hydraulic Research, Marine Technology Society, Permanent International Association for Navigation Congresses, and Western Dredging Association. His professional activities include being a member of the prestigious, Marine Board, National Academy of Engineering; Secretary, Rubble Mound Structures Committee, ASCE; secretary, Coastal Engineering Research Council, Waterway, Port, Coastal and Ocean Division, ASCE; and editor of the Proceedings of the world's most prestigious international coastal-engineering conference, the International Conference on Coastal Engineering.

Dr. Edge is the Co-Director of the U.S. Army Engineer Waterways Experiment Station/Texas A&M University Graduate Program.

Kenneth J. Eisses

Mr. Eisses received a Bachelor of Science degree in civil engineering from the University of Washington in 1981. He received a Master of Engineering degree in ocean engineering from Texas A&M in 1991 in association with the U.S. Army Corps of Engineers Coastal Engineering Education Program. Mr. Eisses has worked at the U.S. Army Engineer District, Alaska, for the past 24 years and is currently the Chief of the Hydraulics/Hydrology Section, Civil Works Branch, of the Alaska District.

Luci Eningowuk

Ms. Eningowuk is currently the Chairperson of the Shishmaref Erosion and Relocation Coalition to help with the erosion and relocation issues of the community of Shishmaref. She graduated from Mt. Edgecumbe High School in 1968, graduated from Alaska Business College in 1970, and attended the X-CED and University of Alaska, Anchorage - RD programs. Ms. Eningowuk worked as a keypunch operator for the State of Alaska, Alaska State Bank, and Fish and Game. She has served as Shishmaref Native Corporation Secretary, Community Health Aide in Shishmaref, the Shishmaref Native Corporation Executive Director and Land Planner, and Kawerak Transportation Administrative Assistant.
Ms. Eningowuk is a member of the Native Village of Shishmaref Board of Directors; Health Council in Shishmaref; Norton Sound Health Corporation Board; and Kawerak, Inc., Board. She has been on the Housing Board of Commissioners for Bering Straits Regional Housing Authority for 5 years. She is a past member of the Shishmaref Dog Mushers Association and past AEC Chair.

Al Ewing

Mr. Ewing is the Executive Director of the Denali Commission, a new organization created through the efforts of Senator Ted Stevens to assist in building the infrastructure and economy of Alaska. Over the past 20 years he has been deeply involved with industry, government at all levels, and the people of the state of Alaska in solving problems and assisting in efforts to achieve sustainable economic growth. Mr. Ewing came to Anchorage in 1985 as the Director of the U.S. Environmental Protection Agency (EPA), a position he held until July of 1996. He served as the Deputy Commissioner of the Department of Environmental Conservation from July 1996 through November of 1998. Prior to coming to Alaska, Mr. Ewing was the Director of the EPA in the state of Washington. He has served in a variety of positions with the EPA in Oregon, Washington, and Washington, D.C. Mr. Ewing has a B.S. degree from Oregon State University and completed course work for a Masters of Public Administration at The Evergreen State College in Olympia, WA.

Dr. Henry P. Huntington

Dr. Huntington is an independent researcher specializing in various aspects of human-environment interactions in the Arctic, including subsistence hunting, traditional ecological knowledge,conservation, co-management, and the impacts of climate change. His research has been funded by the National Science Foundation, the Marine Mammal Commission, the Department of the Interior, and other agencies and organizations. Dr. Huntington has served as a lead author in the Arctic Monitoring and Assessment Program and the Arctic Climate Impact Assessment. He has written many academic and popular articles, as well as two books.

Alan C. Jeffries

Mr. Jeffries has a Bachelor of Science degree in environmental resources engineering and a Master of Science degree in civil engineering. He is a professional civil engineer in the state of Alaska and has 12 years experience with the U.S. Army Engineer District, Alaska. Projects include small boat harbor design, deep draft navigation, river and coastal erosion protection, flood control, and flood plain management.

Molly McCammon

Ms. McCammon is currently the Executive Director of the Alaska Ocean Observing System, a coalition of partners including the University of Alaska, Federal and state agencies, and NGOs, working together to integrate ocean observations and provide better information for users of the ocean and ocean resources. She is the co-chair of the National Federation of Regional Associations for Coastal and Ocean

Observing. Prior to that, she served for nearly a decade as the Executive Director for the *Exxon Valdez* Oil Spill Trustee Council, administering the restoration fund established as a result of a court settlement between the United States government and the state of Alaska and Exxon Corporation following the 1989 *Exxon Valdez* oil spill.

Ms. McCammon came to Alaska 30 years ago after graduating from the University of California at Berkeley with a degree in journalism. Since then, she has homesteaded in the Brooks Range, reported for radio and television news, and served as a natural resource policy specialist for former Governor Bill Sheffield, the Alaska Department of Fish and Game, and the Alaska State Legislature.

John G. Oliver

Mr. Oliver received a Bachelor of Science degree in civil engineering from Oregon State University in 1961. He obtained a diploma with distinction for advanced hydraulic engineering training from Delft the Netherlands in 1973. Mr. Oliver became a registered civil engineer in 1966. He was employed by the U.S. Army Corps of Engineers, Portland District, from 1961 to 1971, and was Chief of Tidal Hydraulics from 1966 to 1971. From 1971 to 1993, Mr. Oliver was employed by North Pacific Division, and was Chief of the Hydraulics and Civil Works Branch from 1990 to 1993. From 1993 to the present, Mr. Oliver has been a private consultant. His consulting experience has included mudflows in the Philippines, flood control in Korea, and many port and harbor projects in the western states of the United States. Mr. Oliver was a member of the International Association of Navigation Congress through 1995 and chaired the Committee on Floating Breakwaters, a member of the Committee on Tidal Hydraulics from 1974 to 1993, a member of the Committee on Channel Stabilization from 1976 to 1980 and 1990 to 1993, and Chairman of Automated Coastal Engineering Committee from 1986 to 1993.

Dr. Joan Oltman-Shay

Dr. Oltman-Shay is a Senior Research Scientist and President of NorthWest Research Associates (NWRA), which is a group of 74 Earth scientists and support staff performing basic and applied research. Dr. Oltman-Shay is also an Affiliate of the School of Oceanography (University of Washington). She received her B.S. degree in Applied Physics/Electrical Engineering from the University of California at San Diego and M.S. and Ph.D. degrees in Applied Ocean Sciences and Oceanography from Scripps Institution of Oceanography (SIO), La Jolla, CA. She studied under William Hodgekiss (Marine Physical Laboratory, SIO) and Dr. Robert T. Guza (Center for Coastal Studies, SIO).

Since graduating from Scripps in 1986, she has spent most of her career performing field and model studies of nearshore (shoreline to nominally 10-m depth) wave and current dynamics and the interplay with morphology and sediment dynamics. Much of her work has centered on the analysis of

data from insitu arrays of pressure and current sensors designed to study the surface gravity (wind and infragravity) wave field and the wave-averaged current field. Significant results from those efforts are - the recognition that infragravity waves are ubiquitous with kinematics that agree with theory, and the discovery of shear instability waves of longshore-directed currents. Early in her career, she designed the USACE 8-m-depth wave-directional array and analysis software for the Field Research Facility in Duck, NC, which remains operational today. Her present focus of activity includes remote sensing of nearshore environmental parameters (satellite, airborne, and land-based). She has published over 50 refereed articles, technical reports, and conference papers on these and related topics.

Dr. Oltman-Shay sits on several national and international boards, including the USACE Coastal Engineering Research Board (CERB), the National Academies Ocean Studies Board (OSB), and the Editorial Advisory Board for Elsevier Publications. She has served as Associate Editor for JGR Oceans, and is presently the U.S. Series Editor for the Nearshore and Coastal Oceanography journal (Elsevier Science Publications). Dr. Oltman-Shay is a member of The Oceanography Society, the American Meteorological Society, the Geological Society of America, and the American Geophysical Union. She has additionally served on several national-level committees that develop recommendations on various aspects of coastal science and research. Significant National Academies Press publications from those efforts are – "Enabling Ocean Research in the 21st Century: Implementation of a Network of Ocean Observatories," (2003) "Science for Decisionmaking: Coastal and Marine Geology at the U.S. Geological Survey," (1999), "Oceanography and Naval Special Warfare: Opportunities and Challenges," (1997), "Priorities for Coastal Ecosystem Science," (1994).

Patricia S. (Trish) Opheen

Ms. Opheen became the Chief of Alaska District's Engineering Division on Jan. 17, 2005. She rejoined the District from the Missile Defense Agency where she has been director of technical engineering for 2 years and 9 months. Previously, Ms. Opheen served in the Alaska District as team leader for the Clear Radar Upgrade and DoD Schools/Department of Education Program. From 1992-1996, she was the Air Force Programs project manager. During this time, in 1995, the Alaska District was awarded the U.S. Air Force Design Agent of the Year. In 1996, the Air Force program split, and she retained the Clear Radar Upgrade project, which was just starting up, and the Department of Defense Schools/Department of Education Program. She led the team in completing over $100 million in renovation and additions to schools on DoD Installations. The Clear Radar Upgrade, a $110-million program involving $47 million in military construction funds, met all customers' expectations and earned the Alaska District Team the USACE Project Delivery Team of the Year award for 2001. For her work on this project, she was named the Air Force Space Command Project Manager of the Year in 2000.

Ms. Opheen joined the Corps with the Engineer-in-Training (EIT) program at the St. Paul District in 1978. After completing the EIT program, she chose Construction Branch and worked as an onsite representative and project engineer at projects in North Dakota, Minnesota and Wisconsin. She transferred to the Western Area Office, Vandenberg Air Force Base, California, in 1982, where she worked in the Contract Administration Branch. She negotiated change orders on the MX Missile program and space shuttle projects. In 1984, she was the project engineer on several projects relating to the space shuttle program. She served as an expert witness for the government at the Armed Services Board of Contract Appeals, assisting in defense of claims on an MX construction contract, with a favorable outcome for the government.

She joined the Alaska District in 1984 as the office engineer in the Elmendorf Resident Office. She managed a technical team who reviewed material submittals, initiated and processed modifications, and administered the contracts involving military, environmental, and civil works. From 1985-1990, she was an instructor for the Prospect Course "Construction Contract Negotiations". She served as the onsite Administrative Contracting Office and Contracting Officer's Representative for the Snettisham Hydroelectric Power Project in Juneau in 1988 and 1989. She led the activities of four service contracts and the construction contract through the Crater Lake Tap, initial tunnel filling, and first spin of the turbine/generator unit.

In 1990, Ms. Opheen obtained her Master of Science in Civil Engineering under the USACE Long-Term Training Program. She returned to the Alaska District in Project Management, when it was part of Engineering Division, where she managed Air Force project designs.

MG Don T. Riley

MG Riley assumed duties as the Director of Civil Works, Headquarters, U.S. Army Corps of Engineers on 1 July 2004. MG Riley came to the Directorate of Civil Works following command of the Mississippi Valley Division (MVD) in Vicksburg, MS, where he also served as President-designee of the Mississippi River Commission (MRC). Prior to commanding MVD, MG Riley served as the Deputy Chief of Staff, Engineer, Headquarters, U.S. Army Europe.

As the Director of Civil Works, MG Riley plays a vital role in managing the Corps $5.0 billion annual Civil Works Program focused on meeting the Nation's water resources challenges.

MG Riley is a graduate of the United States Military Academy at West Point, NY, and was commissioned in the Corps of Engineers in 1973. He earned a master's degree in civil engineering from the University of California, Berkeley, and is a registered professional engineer in the state of California.

He is a graduate of the U.S. Army Command and General Staff College, School of Advanced Military Studies, and the United States Army War College.

MG Riley's troop assignments include duty as platoon leader, assistant, S-3, company executive officer, and company commander, 14th Engineer Battalion, Fort Ord, CA; Assistant Division Engineer and Chief, Plans and Exercises, G3, 3rd Armored Division; S-3, 23rd Engineer Battalion; Deputy G3, 5th Infantry Division; Commander, 7th Engineer Battalion, Fort Polk, LA; Commander, 17th Engineer Battalion, Fort Hood, TX; Chief, Plans and Exercises, G3, I Corps; Commander, 555th Engineer Group, Fort Lewis, WA; Director, Maneuver Support Battle Lab, Fort Leonard Wood, MO; and Executive Officer to the Commanding General, U.S. Army Training and Doctrine Command, Fort Monroe, VA.

In addition, MG Riley has served as Contract Construction Engineer for the Corps' Far East District in Korea. He also held the following positions at the United States Army Engineer Center, Fort Belvoir, VA: Instructor; Aide-de-Camp to the Commanding General; Chief, Captain's Training Team, Directorate of Training and Doctrine; Instructor/Team Leader, Engineer Officer Advanced Course; and Chief, NCO Training Division, Department of Military Engineering.

COL James R. Rowan

COL Rowan assumed command of the U.S. Army Engineer Research and Development Center (ERDC) on 26 July 2003. ERDC is the U.S. Army Corps of Engineers' distributed research and development command and consists of seven unique technical laboratories.

In addition to the four laboratories co-located with the ERDC headquarters in Vicksburg, MS, laboratories are located in Hanover, NH; Champaign, IL; and Alexandria, VA. ERDC employs over 2,000 civilian and military personnel and has an annual research program of over $660 million. It also has over $1.2 billion in facilities and equipment, including some of the most unique and modern research capabilities in the world.

ERDC research and development (R&D) supports the Department of Defense and other agencies in military and civilian projects. Principal research mission areas include water resources (civil works), military engineering, battlespace environment, military installations, and environmental quality. ERDC was named the Army's Large R&D Organization of the Year in 2002.

Prior to assuming command of ERDC, COL Rowan was Commander of the 1st Engineer Brigade, Fort Leonard Wood, MO. Previous assignments include Director of Training, U.S. Army Engineer School, Fort Leonard Wood, MO; Chief of Military Engineering and Topography, U.S. Army Europe; Commander, 54th Engineer Battalion, Bamberg, Germany; Commander, 16th Engineer Battalion, Tuzla, Bosnia; Commander, 3rd Engineer Training Battalion, 2nd Regional Training Brigade, Fort Lewis, WA; and 4th Infantry Division Engineer Brigade S3 and Executive Officer, 299th Engineer Battalion, Fort Carson, CO. COL Rowan also served as an instructor and assistant professor, Department of Mathematical Sciences, U.S. Military Academy, West Point, NY. He has also served as a battalion S4,

company commander, battalion operations officer, bridge platoon leader, engineer platoon leader, and company executive officer.

COL Rowan is a graduate of the U.S. Military Academy at West Point. He holds a master's degree in Operations Research and Systems Analysis from Georgia Institute of Technology; a master's degree in Military Science from the U.S. Army Command and General Staff College; and is a graduate of the U.S Army War College.

His awards include the Meritorious Service Medal, the Army Commendation Medal with two Oak Leaf Clusters, the Army Commendation Medal with one Oak Leaf Cluster, the NATO Medal, the Armed Forces Expeditionary Medal, the Army Superior Unit Award, and the de Fleury Medal. In addition, he is entitled to wear the Ranger Tab and Parachutist Badge.

Bruce R Sexauer

Mr. Sexauer began his Corps career as a hydrologic technician with the U.S. Army Engineer District, Seattle, as a summer hire in 1991, and returned in 1993 after he earned his degree in civil engineering from the University of Washington in 1992. Being born, raised, and educated in the Seattle area, he spent much time on and around the rivers and waterways of the Puget Sound area, giving him a natural affinity for a the wide variety of water resources. His work in hydraulics and hydrology included reservoir regulation and development of the District hydromet system. In 1996, Mr. Sexauer transferred to Civil Works Planning, where he managed and planned several flood damage reduction and ecosystem restoration studies. In 2000, he was selected to manage the Seattle District's General Investigation program, overseeing both the fiscal and policy aspects of the program. During this time, he was given extended assignments as acting Chief of Planning Branch and acting Chief of Civil Programs. In 2003, he participated in the Planning Associates Program. Also in 2003, Mr. Sexauer accepted a position as a Senior Plan Formulator in the Alaska District, where his primary focus has been coastal erosion issues, specializing in projects and studies that are mostly outside of traditional Corps policies and programs. Mr. Sexauer is a registered professional engineer in the state of Washington.

Eileen L. Shea

Ms Shea currently serves as the Climate Projects Coordinator at the East-West Center in Honolulu, HI. In this context, she continues work in climate forecast applications, climate vulnerability assessment, and climate risk management with a primary focus on Pacific Islands. Recent and ongoing projects include: an initial assessment of the consequences of climate variability and change for Pacific Islands; a Pacific Islands Training Institute on Climate and Extreme Events organized in collaboration with the University of the South Pacific and the New Zealand National Institute of Water and

Atmospheric Research, an ongoing review of the first decade of operation of the Pacific ENSO Applications Center; and the Pacific Regional Integrated Science and Assessment Program focused on enhancing the resilience of Pacific Island communities, businesses, and ecosystems in the face of climate-related extreme events such as droughts, floods, and tropical cyclones. Ms. Shea is involved in a number of Asia-Pacific regional endeavors focused on improving coordination among scientific institutions and government agencies engaged in climate and environmental observations, forecasting, assessment, and risk management programs including: service on the Regional Committee of the Pacific Islands Global Climate Observing System Program and leading regional efforts to develop of a Pacific Islands Integrated Ocean Observing System. Prior to joining the East-West Center in 1998, Ms. Shea served as the founder and Executive Director of the Center for the Application of Research on the Environment (part of the Maryland-based Institute for Global Environment and Society) and before that spent over 18 years in government service in the U.S. National Oceanic and Atmospheric Administration (NOAA), culminating in her position as the Deputy Director of the NOAA Office of Global Programs. During her time in NOAA, Ms. Shea helped organize the NOAA Climate and Global Change Program and the inter-agency U.S. Global Change Research Program. Ms. Shea also served for 2 years as Environment and Natural Resources Staff Director for the Board on Sustainable Development of the U.S. National Research Council and has experience in congressional relations and budget and finance in NOAA. Her educational experience focused on marine science and environmental law and resource management at the University of Delaware and the Virginia Institute of Marine Science, College of William and Mary.

Governor William J. Sheffield

Governor Sheffield has been a leader in business, government, and politics for most of the 50 years he has lived in Alaska. He served as governor from 1982 to 1986 following a business career in which he started and built a company that became one of the largest private employers in Alaska and the Yukon Territory. Since leaving office in 1986, Governor Sheffield has taken seats on several private and nonprofit boards of directors, served as economic development consultant specializing in natural resource development, and founded the Alaska chapter of the Democratic Leadership Council. He is a trustee of Alaska Pacific University; a member of the Advisory Board of ENSTAR Natural Gas; a charter member of Commonwealth North, Alaska's leading public affairs forum; Past Chairman of the Federal Salary Council; former Alaska Chairman of the United Nations 50th year celebration; retired President and CEO of the Alaska Railroad Corporation and an active Board member today. After 3 months of retirement, the Mayor of Anchorage appointed Governor Sheffield to be Port Director of the Port of Anchorage. Governor Sheffield has developed a Master Plan for development of the port, increased port awareness and implemented an expansion plan that started in 2004 and will be completed in 2020.

Dr. Orson P. Smith

Dr. Smith is currently a Professor of Civil Engineering at the University of Alaska, Anchorage. He came to Alaska in 1973 to join the U.S. Army Engineer District, Alaska, as an intern. He became Chief of the Navigation and Flood Control Branch in 1975 when the District operated three dredges and Two hydrographic survey vessels. In 1981, he became Chief of the Coastal Planning Section at the Alaska District. Dr. Smith left Alaska in 1983 to join the Coastal Engineering Research Center in Vicksburg, MS. He left the Corps in 1986 to begin doctoral studies, but returned to the Alaska District in 1991 as a manager of port and coastal feasibility studies. He left the Corps again in 1998 to join the University of Alaska, Anchorage School of Engineering faculty, where he had been an Adjunct Professor since 1992 teaching coastal engineering and water-related courses. Dr. Smith earned a B.S. degree in mechanical engineering from the University of Kentucky in 1971, a graduate diploma in coastal engineering at Delft in the Netherlands in 1979, an M.S. degree in civil engineering from Mississippi State University in 1986, and a Ph.D. degree in physical oceanography from North Carolina State in 1989. He has been a registered professional engineer in the state of Alaska since 1983.

Thomas D. Smith, P.E.

Mr. Smith received an undergraduate degree in ocean engineering from the Florida Institute of Technology in 1989. He received his master's degree in ocean engineering from Texas A&M University in 1994 in association with the U.S. Army Corps of Engineers Coastal Engineering Education Program. Mr. Smith worked in the Jacksonville District until March 2003, where he served as team leader of the district's Coastal Center of Planning Expertise. He is currently the senior coastal engineer in the Civil Works Technical Branch, Engineering and Construction Division, of the Honolulu District and focuses on hurricane storm damage reduction and navigation project design. Mr. Smith is project manager for the Manele Small Boat Harbor Operations and Maintenance dredging contract as well as the Southeast Oahu Regional Sediment Management and Sacred Falls Section 227 Demonstration Projects.

Kenton P. Taylor

Mr. Taylor began his career in 1971 as a wildlife biologist in Alaska for the Alaska Department of Fish and Game. He has worked in both research and management capacities with most of Alaska's larger wildlife species in several locations across the state. Ken has served as the regional wildlife management coordinator for the Interior and Arctic Region, Deputy Director of the Division of Wildlife Conservation, and the Director of the Habitat and Restoration Division. In 2003, Mr. Taylor was asked by the Department of Natural Resources to serve as the State Coordinator for North Slope oil and gas

development projects. He also served as the State Gasline Coordinator prior to accepting his present position as the Executive Director of the North Slope Science Initiative.

Dr. R. Bruce Taylor

Dr. Taylor formed Taylor Engineering, Inc., a consulting firm specializing in water resource and coastal engineering in 1983. He received his B.S. degree from the U.S. Naval Academy in 1964, his M.S. degree in oceanographic engineering from the University of Miami in 1971, and his Ph.D. degree in civil and coastal engineering from the University of Florida in 1974. Prior to his current position, Dr. Taylor was Vice President and Principal of Florida Coastal Engineers, Inc., and Tetra Tech, Inc., as Manager of the company's first office in the southeastern United States and later as Director of East Coast Operations. Dr. Taylor has consulted on a variety of coastal engineering and water resource projects. These include the analyses of navigation project impacts on littoral processes, coastal erosion and shore protection projects, flood hazard studies in support of the National Flood Insurance Program, harbor engineering and dredging operations, and the mathematical modeling of coastal hydrodynamics, discharge plumes, and pollutant transport. Dr. Taylor has authored refereed journal articles and numerous technical reports and has served on several advisory boards and committees. He served as technical advisor to the State of Florida on coastal management issues related to river basin and estuarine systems and currently serves as Chairman of the Northeast Florida FEEDS Advisory Council for graduate engineering education, Chairman of the College of Engineering Deans Council, and Chairman of the Florida Virtual Campus Board of Directors. Dr. Taylor's professional memberships include the Engineering Advisory Council to the University of North Florida's College of Computing Sciences and Engineering, the Coastal and Oceanographic Engineering visiting Committee of the University of Florida, the Society of Military Engineers, the National Society of Professional Engineers, and the Western Dredging Association. He is past president of the Northeast Florida Chapter of the Florida Engineering Society and a Fellow of the American Society of Civil Engineers and the Florida Engineering Society. Dr. Taylor received the 1997 Outstanding Technical Achievement Award from the Florida Engineering Society and the 1998 Regional Engineer of the Year Award from the Florida Engineering Society. In 1999, he received the nationwide National Society of Professional Engineers Award.

BG Merdith W. B. "Bo" Temple

BG Merdith W. B. (Bo) Temple assumed command of the North Atlantic Division (NAD) of the U.S. Army Corps of Engineers on 25 November 2002. He joined the Division after a tour as Commander of the Corps' Transatlantic Programs Center in Winchester, VA.

NAD is one of eight Corps of Engineers regions providing engineering and construction services to the Nation. It is the Corps' regional business center in the Northeast and 51 other countries, with district offices in Concord, MA; New York City; Philadelphia; Baltimore; Norfolk; and Wiesbaden, Germany.

As Division Commander, BG Temple oversees the planning, design and construction of projects to support the military, protect America's water resources, and restore and enhance the environment within a 180,000-square mile area along the Atlantic Coast, including 13 states from Maine to Virginia and the District of Columbia. He is also responsible for the Division's work with a variety of engineering and construction activities for international, Federal, state, and local governments, and agencies in the United States and overseas.

BG Temple, a Virginia native, was commissioned in the Engineer Branch in 1975. He earned a bachelor's degree in civil engineering from the Virginia Military Institute and a master's degree in civil engineering from Texas A&M University. He is also a graduate of the U.S. Army Command and General Staff College and the U.S. Army War College, and he is a registered professional engineer in the Commonwealth of Virginia.

BG Temple has held numerous command and staff positions in the United States and overseas. Most recently, he served as the C7 (Engineer), Combined Joint Task Force Seven, Baghdad, Iraq. Besides his tour as Commander, Transatlantic Programs Center, he served as the Assistant Chief of Staff, Operations (G3), XVIII Airborne Corps at Fort Bragg, NC. He has been stationed at Fort Bragg for multiple assignments: With the 548th Engineer Battalion (Combat Heavy), 20th Engineer Brigade (Combat) (Airborne Corps); the 307th Engineer Battalion, 82d Airborne Division; as commander, 307th Engineer Battalion: and as commander, 20th Engineer Brigade (Combat) (Airborne Corps). He has served with the U.S. Army Personnel Command Center in Virginia and as a Reserve Component advisor with the Readiness Group in Colorado.

Before serving in Iraq, BG Temple served overseas with the 44th Engineer Battalion, Korea; with US Army Europe and 7th Army, Germany; with the 307th Engineer Battalion in Saudi Arabia during the Persian Gulf War; and with NATO Headquarters in Turkey.

BG Temple's military decorations include the Legion of Merit (two oak leaf clusters), the Bronze Star Medal, Defense Meritorious Service Medal, the Army Meritorious Service Medal (six oak leaf clusters), Joint Service Commendation Medal, the Army Commendation Medal (four oak leaf clusters), the Army Superior Unit Award, and the Master Parachutist Badge.

Stanley Tom

Mr. Tom works as a volunteer for Tribal Liaison for Newtok Traditional Council. In 1992, he inherited his father's small grocery store, which he built during the late 1970s. Since taking over the store, Mr. Tom has added heating fuel and marine gas and currently has seven employees. During the 1970s, Mr. Tom attended boarding high school at St. Mary's, AK, and graduated in 1980. He majored in business in college, but returned shortly thereafter to begin working for his community. In his community, Mr. Tom was a janitor for the city government, became mayor in 1996 until the city government was dissolved in January 1997. In 1997, Mr. Tom became president of Newtok Traditional Council and, later became Tribal Housing Administrator, a position he still maintains.

Bruce W. Turner

Mr. Turner is currently a geophysicist with the West Coast and Alaska Tsunami Warning Center in Palmer, AK. He received a B.S. degree in chemistry from Knox College, and an M.S. degree in geology and geophysics from the University of Hawaii, Manoa. He was a Lieutenant Commander – USNR-R; a geophysicist with the U.S. Geological Survey and Minerals Management Service, Alaska; and a geophysicist with the Pacific Tsunami Warning Center, Hawaii.

BG Michael J. Walsh

BG Walsh assumed command of the South Atlantic Division (SAD) on 24 June 2004. His previous assignment was Chief of Staff, U.S. Army Corps of Engineers (USACE).

As SAD Commander, BG Walsh oversees engineering, construction, and real estate activities for the Army and Air Force in the Southeastern United States, Latin America, and the Caribbean. He is also responsible for water resources development activities, which include management of major harbors, Federal navigable waterways, and multiple-purpose reservoirs.

As USACE Chief of Staff from May 2003 to June 2004, he was responsible for directing, coordinating, supervising, integrating, and training more than 900 personnel to provide responsive engineering support to the Army and Nation at home and abroad. He worked closely with Army, other MACOMs, Department of Defense staff, and members of Congress to ensure USACE provided exceptional support to the Army and Nation in peace and war.

BG Walsh served as USACE Executive Director of Civil Works from August 2001 to May 2003. He provided executive direction and oversight to 200 personnel in the DC headquarters and to 25,000 Corps employees who execute the daily civil works mission throughout the United States. BG Walsh's career includes two USACE district commands: Sacramento District from 1998 to 2001 and San Francisco District from 1994 to 1996.

BG Walsh has held a wide variety of Army command and staff assignments. They include project management officer for Engineer Branch, Supreme Headquarters, Allied Powers, Europe (SHAPE); Environmental Task Force Leader, Fort Stewart, GA; Executive Officer, 92nd Engineer Battalion, Fort Stewart, GA, and Saudi Arabia; Project Engineer and Assistant Area Engineer, Baltimore District; Construction Officer, 18th Engineer Brigade, Darmstadt, Germany; and Commander, Company B, 94th Engineer Battalion, Darmstadt, Germany.

BG Walsh graduated from Polytechnic Institute of New York in 1977 with a bachelor's degree in civil engineering. He also earned a master's degree in construction management from the University of Florida. His military education includes the Engineer Officers Basic and Advanced Courses, U.S. Army Command and General Staff College, and the U.S. Army War College.